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SELECTIONS

FROM

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108455

N. W. P.

PART VI - XI

AGRA:

PRINTED AT THE SECUNDRA ORPHAN PRESS.

ERRATA IN SETTLEMENT REPORT,

PERGUNNAH KURNAUL.

Page 31, para. 3, *Note*, for "these," *read* "three"

,, 32, ,, 9, line 6, for "establishing," *read* "exhibiting."

,, 33, ,, 9, ,, 11, for "$11\frac{21}{2}$," *read* "$12\frac{1}{2}$."

,, 33, ,, 13, ,, 5, for "almost," *read* "about."

,, 34, ,, 19, ,, 2, for "when," *read* "where."

,, 34, ,, 19, ,, 4, for "Lohmuh," *read* "Sohnuh."

,, 35, ,, 25, *Note* "†," line 7, for "Koomars," *read* "Kumeens."

,, 37, ,, 36, line 7, for "proving." *read* "forming."

,, 38, ,, 42, ,, 2, for "lanceemount," *read* "and sunee; moat."

,, 39, ,, 44, ,, 9, for "Muduk," *read* "Nirduk."

,, 40, ,, 48, ,, 2, for "protected," *read* "practised."

,, 43, ,, 62, *Note* 1, for "Assamees," *read* "assessment."

,, 44, ,, 70, line 4, for "forts," *read* "first."

,, 46, ,, 77, ,, 3, for "*after* Pertual," *insert* "I thought this arrangement best, both because"

,, 46, ,, 77, ,, 5, for "scattered," *read* "settled."

,, 49, ,, 99, ,, 4, for "these," *read* "there."

,, 51, ,, 107, ,, 4, for "*after* pergunnahs;" *insert* "which are, in the present case, Panceput,"

2nd Table.

,, 51, ,, 108, line 2, for "Land Bangur," *read* "Canal Bangur."

,, 55, ,, 126, ,, 10, for "contradiction," *read* "contradistinction."

,, 57, ,, 140, ,, 4, for "muhla," *read* "mulba."

,, 58, ,, 141, ,, 11, for "spade," *read* "spud."

,, 58, ,, 142, ,, 6, for "above," *read* alone."

,, 59, ,, 148, ,, 11, for "measure," *read* "measurer."

,, 64, ,, 179, ,, 9, for "individual," *read* "Mundul."

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SELECTIONS

FROM THE

RECORDS OF GOVERNMENT.

No. XXVIII.

BRIDGE OVER THE RIVER KUNOUT AT SHAHJEHANPORE.

Constructed for the RANEE *of* POWAINE, *under the superintendence of the District Road Fund Committee, on a design supplied by* COLONEL ABBOTT.

(GOVERNMENT ORDER, No. 5491 OF 1848.)

FROM C. ALLEN, ESQUIRE,

Offg. Secy. to Govt. in the N. W. P., Judl. Dept.,

TO H. PIDCOCK, ESQUIRE,

Commissioner of the Rohilcund Division,

Dated Agra, the 14th November, 1848.

SIR,

In reply to your letter of the 1st instant No. 93, with enclosures, reporting the completion of the bridge over the river Kunout, at Sindhowlee Ghaut, in zillah Shahjehanpore, I am directed to express the gratification of the Honorable the Lieutenant Governor, on receiving intelligence of the completion of this highly useful and ornamental public work, and to beg that you will

communicate to the Ranee of Powaine, the satisfaction which His Honor derived from inspecting it last year in its incomplete state, and now from receiving intelligence of its being completed in all its parts.

2. To Mr. C. B. Thornhill, the Joint Magistrate and Deputy Collector, the thanks of the Government are due for his public spirited exertions, not only in this, but also in many other works, in which he has most ably and zealously seconded the efforts of the Collector and Magistrate, Mr. F. P. Buller, for promoting the comfort of the people, and for developing the resources of the country. To both those gentlemen and others, who were, and are still, associated with them in the Local Committee, the people of the district, and through them the Government of the country, lie under a great and constantly accruing obligation, which no doubt finds its highest reward in the successful result of these benevolent efforts.

3. As the chief labor and responsibility of this work seems to have rested on Mr. C. B. Thornhill, you will be pleased to communicate to him through the Local Committee the thanks of the Government.

I have, &c,

C. ALLEN,

Offg. Secy. to Govt., N. W. P.

Agra:
The 14th November, 1848.

Report by C. B. THORNHILL, Esq., C. S. *(Secretary, Road Fund Committee) on the building of the* RANEE'S *Bridge at Sindhowlee Ghaut, Shajehanpore.*

In the early part of the year 1845, the Ranee of Powaine who is in possession of extensive estates, about 16 miles north of the station of Shajehanpore, applied through the Collector for a loan from Government of Rs. 24,000 for the purpose of building a masonry bridge over the river Kunout, which runs across the road from Powaine to the station and city; and at the same time requested the Road Fund Committee to undertake the work for her.

2. The sanction of Government having been received on both points, the Committee at once applied to the Superintending Engineer, Colonel Abbott, submitting for his approval their design, which consisted of 5 arches of unequal spans, giving a total waterway of 170 feet, of which the largest being placed in the centre, raised that part of the bridge above the flanks, the object being to allow of the passage of boats under the bridge during

floods, and at the same time save the heavy expense of embanked approaches.

3. Colonel Abbott, while he approved of the plan sent up by the Committee, suggested the great advantage in appearance which a bridge gains, by having the arches of equal size, and the lines of the parapets, &c. parallel to the horizon, and urged that the additional cost of the embankment would be amply repaid by the effect which would be gained. At the same time he sent a design of his own, which was immediately adopted by the Committee. It consisted of three arches of equal span and rise, giving a total waterway of 150 feet; Colonel Abbott also expressed a wish, that masonry blocks, which have been found to succeed so well upon the Ganges canal, should be adopted in the foundations.

4. The design having been determined upon, the next point to be considered, was the site. The course of the river Kunout is very tortuous, and in the vicinity of Sindhowlee its valley is extensive; the breadth of the flood, which rises on an average only 9 feet, being nearly ¼ of a mile. It was therefore necessary to take advantage of the ground, so as to reduce the embankment as much as possible.

5. The river has never been known to shift its bed, which being composed of a tenacious clay over which the water seldom flows with any rapidity, there was little danger to the bridge to be apprehended on that score.

6. To ascertain the rate at which the floods passed through the valley, advantage was subsequently taken of the construction of the Bridge of Boats at Lodheepoor, eight miles below Sindhowlee, to contract the outlet of the flood to 125 feet. Through this, the greatest velocity attained by the water, was 4 feet per second; or a little less than 3 miles an hour.

7. There being then no perceptible destructive action of the river upon its banks, the necessity for placing the bridge below a long staight reach was obviated, and the selection of the present position was caused by its proximity to high ground on the north bank.

8. The bridge was placed at right angles to the course of the floods, without reference to the summer water of the river; which it was decided could be subsequently directed towards the bridge, by cutting a canal through the isthmus of the reach above it.

9. A reference to the plan of the abutments in the accompanying sketch, will shew the nature of the blocks which form their foundations. A framing of 12 saul timbers each one foot square, was constructed by laying 6 timbers in pairs, with a space of 5½ feet between each pair at right angles, to 6 others similarly paired. These being let into each other by halving, a platform was produced in which there were four square apertures

of about 5 by 5¼ feet each. The corners of these were again filled in so as to make the aperture octagonal. Two platforms thus formed and strongly secured with iron bolts and straps, were placed in *situ*, six feet apart, on the southern bank of the river, in an excavation which had been carried down to the water.

10. On the 21st June 1845, the Ranee of Powaine herself proceeded to the spot, and (concealed by the trench) laid the first brick with much formality; the event being celebrated by a display of fire-works.

11. Before laying the masonry upon the timbers, iron rods 3-8 inch diameter were thrust through holes bored in the platform, and secured below by nuts; the upper part of the rods were then turned into loops one above the other at about 1 foot apart; and through these loops wooden staves were inserted parallel to the platform below. The masonry was then proceeded with in the usual way; the bricks laid round the octagonal apertures being dressed to a point in their centre, as in a circular well. The courses, as they rose, built in the staves, so that the platform became most securely attached to the brick work. This precaution was found of great service, when the blocks reached a depth of about 18 feet, for the friction produced by so large a surface in contact with the closely compacted sand, through which it was sunk, rendered the descent very slow, and although the blocks were loaded above with an enormous weight, it frequently happened that the earth was entirely scooped out from below the wooden platform so that had no precautions against such a contingency been taken it would have fallen away from the masonry.

12. At a depth of 17 feet, a thin stratum of small nodules of kunkur was met with. It was not considered safe to leave the blocks at so small a depth upon a doubtful bed. They were therefore carried down to 22½ feet, where the kunkur assumed the formof large masses having the interstices filled with very coarse sand. This stratum was subsequently found to crop out at a distance of about 600 yards to the north of the bridge, and as it forms the support of all the foundations; the slight dip rendered it unnecessary to carry the northern blocks more than 19½ feet below the bed of the river.

13. The operations which have been carried on in the Ganges Canal have produced such detailed reports of the mode of working the blocks, that nothing remains to be said. The large size of the blocks used in the Ranee's bridge, however, rendered the greatest caution necessary, to prevent the surface from becoming unlevel by unequal subsidence of the corners; the correction of this error being a work of great difficulty and delay at all times, and in extreme cases an impossibility.

14. The masonry was built in stories of eight feet, the second story commencing after the Kachees had brought the top of the first to the level of the water by sinking.

15. The piers were founded upon double lines of cylinders as they were thought to be more manageable than large blocks, when the adjustment and commencement of the work was necessarily under water. The four abutment blocks and 16 pier-cylinders having reached the bed of kunkur before alluded to, were filled with chippings of bricks, kunkur, refuse of the lime-kilns, and fine sand, about one foot at a time being filled in, and closely rammed. The apertures were then closed with flat vaults, the surface of the dome being on the level of the bed of the river. To effect this, it was necessary to employ gangs of men night and day to bale the water, so as to keep the masonry from being submerged until the mortar had set.

16. The two blocks forming each abutment were then connected by an arch, and the masonry continued to a height of 9½ feet, a double arch was also introduced into the body of the piers, so as to throw the weight of the bridge upon the centre of the cylinders, and relieve the vaulted spaces between them.

17. Having observed the great difficulty of preventing some settlement in retaining walls, by which an unsightly crack is produced in the parapet, a cylinder was sunk in the line of each wing wall, about 10 feet to the rear of the abutment; 12 feet beyond this, short piles were driven and covered with stout planking; arches were then thrown from the abutment to the cylinder, and again from the cylinder to the piles; so that the enormous weight of the wall, which is 29 feet to the top of the parapet, is divided upon three strong points, instead of being thrown upon the insecure soil, which immediately adjoins the bed of the river.

18. The alterations in the bed of the river, caused by the sinking of the cylinders, had by this time distributed the water between two of the piers, leaving only one arch dry at the commencement of the year 1847. It therefore became necessary to construct two centres, which should offer no obstruction to the floods, should any accident protract the completion of the arches beyond the commencement of the periodical rains.

19. The following design was accordingly selected, as combining the greatest strength with simplicity.—*Vide Sketch II.*

20. When, however, it was erected, the joints were found so defective, in the nicety so necessary to ensure strength by an equal distribution of the stream upon every part; and the skeleton centering first put up, having fallen, in consequence of the neglect of the carpenter to brace it at once, the supports, *Figs.* 2 *and* 3 were added, the former under the southern, and the latter under the middle arch.

21. The northern space was nearly filled with great masses of sun dried bricks, and a pattern having been traced on the

ground, and built upon 6 inches, in relief as a guide, the southern and centre arches were commenced together, and after advancing ⅓rd together, the whole of the masons were put upon the former, so as to complete it at once, and enable the massive centering, which would oppose so great an obstacle to the floods, to be removed. The north arch having been keyed in May, was at once brought to its bearings by a very clever suggestion of Cheda, the head mascn.

22. The support was composed of pillars of sun-dried bricks only. Upon flooding their foundations, they yielded to the superincumbent weight of the arch, which gradually settled 3 inches, within 8 hours of being keyed; the subsequent settlement was not quite half an inch, being nearly 3½ inches altogether. This although trifling, compared to the settlements which took place in many stone bridges under celebrated French Engineers, is nevertheless large, and as will be seen, greatly in excess of that of the other arches.

23. On the completion of the northern, the middle and southern arches were proceeded with. The former, being kept in advance, was completed some days before the latter, and the centerings were lowered by driving out wedges, the moment the arch was keyed. Although the method of inserting these wedges was very rude, compared with that adopted in England, yet, they were found to answer the purpose designed; while the want of skill in the carpenters prevented the attempt of any thing more complicated. The settlement of the middle arch was 2 inches; that of the southern barely 1 inch.

24. The completion of the arches and removal of the centerings before the occurrence of any severe flood, prevented any hindrance to the navigation of the river; but the rise of the water, and consequent submersion of the wing wall foundations, combined with the cessation during rains of all brick making, threatened to delay most seriously the progress of the works. Most opportunely at this juncture, the materials of a distillery, belonging to the late firm of Barron and Co., situated upon the river Kunout, about 40 miles above the bridge, were offered for sale. The Committee at once became the purchasers of the bricks, upwards of 5 lacs of which were floated down the river before the cessation of the floods, and as soon as the traffic of carts recommenced in September, the bridge was so far advanced as to admit of their being allowed to pass over it.

25. The work was continued from this time without any interruption, or the occurrence of any incident deserving of notice, and finally completed on the 9th April 1848.

26. The embanked approaches were commenced in October 1846, and carried up in layers, 5 feet at a time, in order that this foundation of the road might be gradually consolidated by one

whole rainy season, and even with this precaution, when the road had been completed and traffic on it commenced, the subsequent subsidence, by consolidation, was so great, as to cause considerable inconvenience, and require constant repair; nor can it be hoped that this mound of earth (upwards of 25 feet high at the bridge) will be kept in an efficient state of repair, without constant care and attention for some years, and the protection of the grassed slopes from the action of the rain by the construction of low walls on each side of the road, having in them apertures, leading to tiled or masonry shoots.

27. The local circumstances under which this bridge was erected, were upon the whole very favourable. Excellent kunkur for lime was produced within ¼ mile of its site. A good foundation of kunkur was found at 22½ feet below the bed of the river. Charcoal for burning the lime was obtained at a cheap rate from the forests in the north of the district. Timbers for the centres passed down the river during the floods, thereby saving all expenses of land carriage. And lastly, any number of excellent brick-layers was at all times procurable from the city.

28. The trusses which formed the centerings, although composed of heavy timbers were raised with great facility in the following manner. The piers being raised to the intended height and levelled, a large boat, 30 feet beam, was floated between them. Upon this a strong scaffolding was erected, and a platform laid upon it, rather above the piers. To this platform, the timbers were raised singly and then joined together, the feet of the rafters laying upon the temporary piers, upon which the centering was afterwards to rest, in the position they were intended to occupy permanently. The collar-beam and iron tie having been adjusted, the united efforts of about 20 men raised the truss which was secured by guys. The boat was then shifted down the stream, and a second truss raised and secured by wooden braces to the first. The main trusses having been raised and secured, the smaller trusses were adjusted above them, and similarly braced, the form of the arch was approximately given by curved pieces of mangoe wood laid upon the upper trusses, across them bamboos were secured in the usual manner, and the correct curve obtained by a layer of clay protected by a thin coating of mortar.

29. In turning the arches, the correct radiation of the voussoir courses was secured by the erection of a wooden railing on either edge of the centering, the bannisters of which were *radii* to the curve, and a correct plan of half the arch in relief was constructed upon the ground, close to the arch, from which the work was verified from time to time as it advanced.

30. The bricks for the arches were most carefully selected, only those of the deepest red being used.

31. In the southern arch, which was first turned, the mortar was not ground more than 4 hours, in the expectation that by carefully keeping the masonry well moistened until the keying of the arch, and striking the centering instantly, the enormous compression to which it would be then subjected, would bring the bricks into actual contact, and ensure a perfect consolidation of the mass. When, however, the versed sine of this arch was found to have diminished 3½ inches, the possibility of the alteration of the form of the curve in coming to its bearings rendered the repetition of the experiment unadvisable; the mortar was therefore continued in the mill 8 hours for the second arch, (in which the settlement was found to be only 2 inches), and for 12 hours in the third arch, where the versed sine was found to have been lessened only one inch.

32. In stone bridges, where the voussoirs are composed of a single stone, the elasticity of the wooden centering causes each joint to open and close in succession, as the gradual addition of the weight produces a change in the form of the centre.

33. In this bridge, however, the whole effect appears to have accumulated at one point. For when about 13 feet of the arch had been laid, the extrados at about the 40th course commenced opening, and the joint continued to separate until the arch had advanced to about 10 feet, when the direction weight being altered, the aperture then about 1½ inch wide, gradually decreased until, on the keying of the arch, it nearly closed, in consequence of the voussoirs being composed of so many pieces. It did not entirely close, but after the centering was removed, there was still a distinguishable crack.

34. The highest flood level has been placed at the springing of the arches, but although such floods are reported to have occurred, the highest within the last 8 years has not reached within 1 foot of the height of the piers. It was mentioned above, that the breadth of the flood was nearly ¼ mile, this however arises partially from the flood level of the river Ghurra being higher than the Kunout, which flows into it. The cause of this is probably the excessive falls of rain in the hills, where the Ghurra rises; the Kunout on the other hand having its source within the Shahjehanpore district, receives only the drainage of the immediate neighbourhood.

35. Instead then of receiving the superfluous stream of the Kunout, the Ghurra actually pours some of its own flood into it, causing a counter-current, which is felt as high as the city of Shahjehanpore, and a heading up of the stream which is felt above Sindhowlee.

36. The actual flood section, for which it was necessary to provide an outlet at the bridge, may be taken at about 1400 feet, and as this is less than the area of the section of the bridge without the arches, it is to be hoped that no heading up of the water,

and consequent destructive action of the current upon the bed below the bridge need be apprehended.

37. Previously to the setting in of the rains of 1847, the intended canal was cut through the neck of land formed by the bend of the river above the Bridge and the old channel bunded across, so that the Bridge is now at right angles to the permanent bed of the river, as well as to the direction of the floods.

C. B. THORNHILL,
Secy., Road Fund Committee.

Statement of Charges incurred in constructing the Sindhowlee Bridge for the RANEE OF POWAINE.

1.—DIGGING FOUNDATION.

87 Coolies from 1 to 2 annas each,..	9	9	6			
Digging 26 square yards @ 6 pie per yard, ...	8	3	3			
				17	12	9
PLATFORMS (SQUARE.)						
24 Timbers at different rates, ...	420	9	5			
32 mds. of Iron @ 5 Rs. 7 as. 6 pie, and Rs. 9 per maund, ...	193	2	3			
40 Blacksmiths from 2 as. 6 pie to 4 annas each, ...	80	0	0			
1117 Carpenters from 2 as. 6 pie to 4 annas each, ...	163	6	3			
Sawyers for 258 pieces @ 12 and 13 Rs. per 100 piece, ...	31	0	11			
20 Kirbs @ 7 Rs. 3 as. 2½ pie each,	144	0	0			
				1102	2	10
MASONS FOR MAKING CYLINDERS.						
2294 Masons from 1 to 4 annas, ...	571	11	3			
5408 Coolies for aiding Masons from 6 pie to 2 annas 6 pie, ...	459	11	9			
9902 Coolies for lifting up mud, from 2 annas to 2 annas 6 pie, ...	1058	2	3			
264460 Bricks, @ 538 Rs. 12 as. 7 pie per lac, ...	1423	7	4			
7000 mds. of Kunkur lime @ 10 Rs. 13 as. 10 pie per 100 maunds,..	757	10	6			
400 mds. of Stone lime @ 15 as. 3¼ pie per maund, ...	382	11	1			
Sinking 88 feet 1¼ inch Blocks @ 4 Rs. per foot, ...	352	8	0			
Ditto, 59-0-10 feet diameter @ Re. 1 per foot, ...	59	0	0			
Ditto, 232-6-8 feet ditto @ 1¼ as. per foot, ...	203	3	0			
Ditto, 47-0-7 feet ditto @ 12 annas per foot, ...	35	4	0			
Miscellaneous Charges,....	671	8	5			
				5974	13	7
						7094 13 2

2.—PIERS.

1057 Masons from 1 to 4 annas,....			248	1	6
2887 Coolies from 6 pie to 2 annas,			268	8	3
140000 Bricks @ 538 Rs. 12 as. 7 pie per lac, ...			754	8	10
3000 mds. of Kunkur lime @ 10 Rs. 13 as. 10 pie per 100 maunds, ..			346	9	4
2500 m ds. of Stone lime @ 15 as. 3¼ pie per maund, ...			240	9	10
					1858 5 9

3.—Centering and Arches.

Centering.

40 Timbers @ different rates, ...	₹61	7	0		
1595 Carpenters from 2 to 4 annas,..	400	0	0		
760 Blacksmiths from 2 annas 6 pie to 4 annas, ...	134	10	1		
Sawyers for 595 pieces @ 12 and 13 Rs. per 100 pieces, ...	71	4	9		
15 mds. of Iron @ 8 and 9 Rs. per maund, ...	139	6	8		
81 Large iron Screws @ 6 as. each,	31	6	0		
100000 Kucha Bricks @ 4 annas per 1000, ...	25	0	0		
Miscellaneous Charges, ...	720	1	9		
				2283	3 10

Arches.

4588 Masons, from 1 to 4 annas,....	941	10	9		
10348 Coolies from 1 to 2½ annas, ..	1134	14	0		
150000 Bricks @ 538 Rs. 12 as. 7 pie per lac, ...	808	7	9		
3400 mds. of Kunkur lime @ 10 Rs. 13 as. 10 pie per 100 maunds,..	368	4	10		
400 mds. of Stone lime @ 15 annas 3½ pie per maund, ...	382	11	1		
Miscellaneous Charges, ...	95	2	8		
				3731	2 8

4.—Parapet.

2318 Masons from 1 to 4 annas, ...	505	5	9	
5716 Coolies from 1 to 2 annas, ...	564	0	9	
15,080 mds., 20 srs of Kunkur lime @ 10 Rs. 13 as. 10 pie per 100 maunds, ...	1632	14	1	
415 mds. 13 srs. 6 cks. of Stone lime @ 15 as. 3½ pie per md.	400	2	0	
5,10,200 Bricks @ 538 Rs. 12 as. 7 pie per lac,..	2776	13	11	
Miscellaneous Charges, ...	514	13	11	
				6394 2 5

5.—Plastering.

3961 Masons from 1 to 3½ annas, ..	762	13	3	
4735 Coolies from 1 to 2 annas, ...	494	15	0	
10000 mds. of Kunkur lime @ 10 Rs. 13 as. 10 pie per 100 maunds. ..	217	4	8	
207 mds. 26 srs. 10 cks. of Stone lime @ 15 as. 3½ pie per md , ..	200	1	0	
Miscellaneous Charges, ...	78	15	9	
				1754 1 8

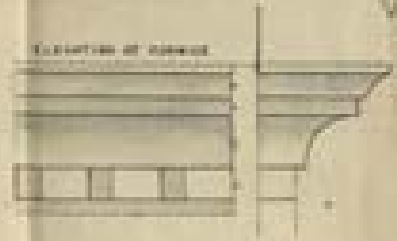
6.—APPROACHES.

1531028 cubic feet road @ 3 as. 6 pie, 3 as. 9 pie and 4 annas per foot,	3768	8	6			
2028 Coolies for sloping sides form 1 to 2 annas, ...	208	12	0			
A dam from bridge to west, ...	60	0	0			
134 Coolies for making dam from 1 to 2 annas, ...	16	5	9			
Compensation for owners of land, ..	93	12	0			
1350 mds. of Kunkur for laying over the bridge @ 1 R. per 100 maunds,....	13	8	0			
				4160	14	3
				27276	11	9
Deduct realized from sale of wood, &c., employed in centering, ...				1276	11	9
Total Co.'s Rs.				26000	0	0

C. B. THORNHILL,

Secretary, Road Fund Committee.

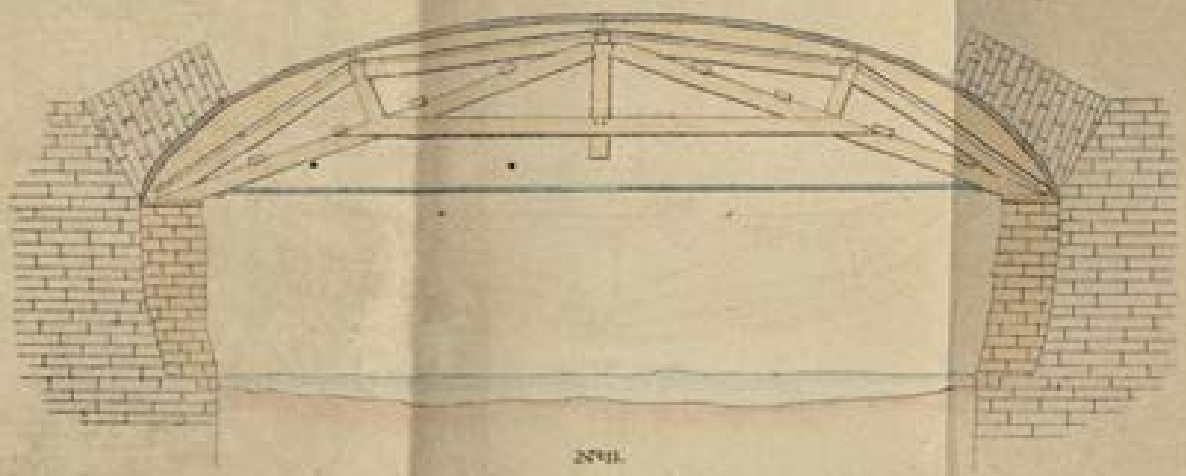
PLAN & ELEVATIONS of a BRIDGE (design by the GHAZIPUR CAWNPORE ROAD FUND COMMITTEE for the RANGE of POWAYNE about 12 miles from Shahjehanpore) as constructed by COL: ABBOTT SUPERINTENDING ENGR. N.W.P.



SKETCH N°2

CENTRES EMPLOYED IN THE ERECTION OF THE RANEE'S BRIDGE AT BURDWAN OVER THE BOWLEE GHAT

N°1



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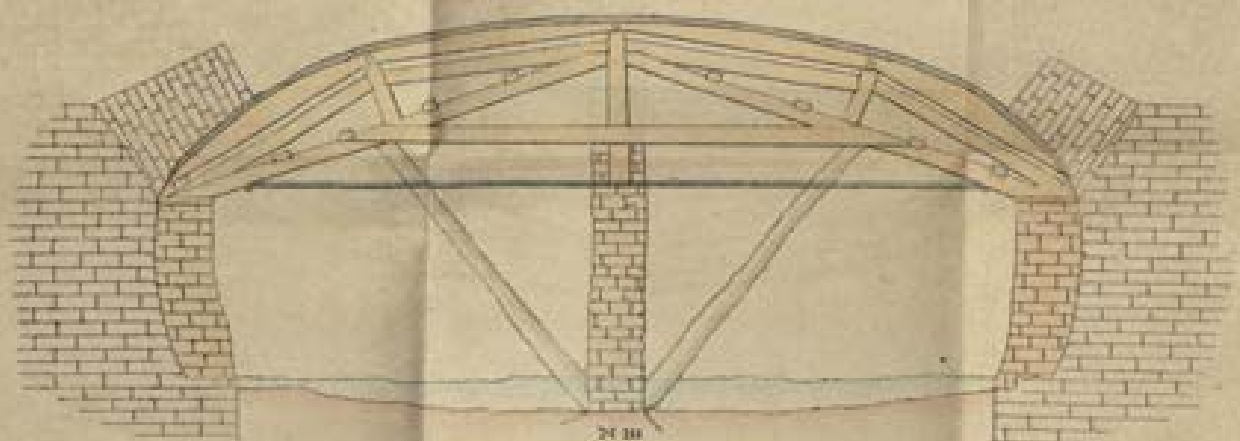

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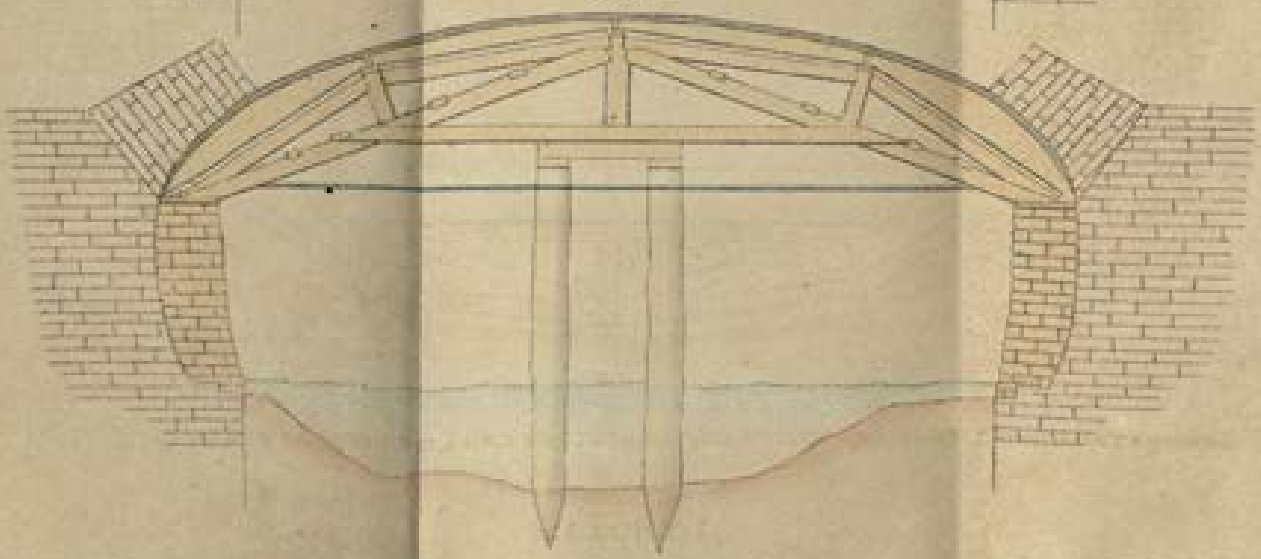


No. XXIX.

BREAK-WATER IN THE JUMNA, AT AGRA.

(LETTER DATED AGRA, THE 28TH AUGUST, 1847.)

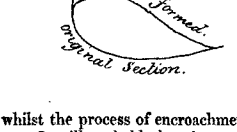
FROM CAPTAIN J. R. OLDFIELD,
Executive Engineer,

To P. B. REID, ESQ.,
Secretary to Local Agents for the Management of Nuzzool Funds, Agra.

SIR,

Having completed the measure, suggested by me to the Local Agents, and authorized by Government, for keeping the strand road under the Fort at Agra from being further cut away by the action of the stream of the Jumna during the present rainy season, I have the honor to forward a statement of the expence incurred, and to report, that along the portions of the strand protected by a chain of bushes, not only has a particle of the bank not been washed away, but that I have reason to hope, that throughout its length, about 1800 feet, a bank of alluvion has been formed, varying in breadth from 10 to 30 feet, and in depth from 5 to 6 feet.

The part protected is from the Shah Boorj of the fort to below the water gate. The section of the bank nearly throughout this length showed in a marked manner the effect of the stream on it last year; being much indented, and nearly perpendicular: which is the form in which the alluvial banks of large rivers in their outer bends are usually left whilst the process of encroachment is going on.



It will probably be observed, that the portion of the strand-road, which lies below that which has been defended, has not suf-

fered injury any more than that which has; but the inference must not thence be drawn that the defence was unnecessary; I need only draw attention to the differing section of the strand, and the differing direction of the stream of the two places. In fact, the parts undefended seemed to me safe, and I proposed only to defend those along which the line of bushes has been laid.

The river having been late in rising, I had, though I commenced work late, time to lay down the row of bushes before the water rose to the foot of the perpendicular portions of the bank on which I feared the action of the stream; and when it did rise, I had the satisfaction of seeing that the bushes produced perfectly still-water in the space between them and the bank; and that the stream in place of cutting away the foot of the latter was entirely turned by the line of bushes. This still-water naturally produced a deposit, which on the falling of the water after the rains may easily be measured.

Besides protecting the bank for the distance above stated I have laid a double row of bushes in the stream across the embayment formed by the total breach of the strand, at its eastern extremity where it meets the inland road to the Taj. This row is laid in deep water, but I expect when the river falls to find an unbroken bank of 5 or 6 feet high along the line of bushes, leaving a pool within them unconnected with the stream, which may be filled up in the cold weather, and the strand once more connected with the road to the Taj.

Besides these two more extensive lines of bushes, I have in some degree protected the bridges on the line of the strand, which seemed in great danger of being left isolated, and probably suffering considerable injury.

The stream this year has, I should suppose, been both lower and more tranquil than usual, and my precautions for keeping the line of bushes from being carried away have been greater than necessary. I have used throughout two ropes of moonje grass, each measuring 2½ inches in diameter, and frequent anchors of heavy stones, whilst from the rapid setting up of the bed of the river where the bushes are laid, they get so soon clogged thereby, as to render them little liable to disturbance, especially as they offer at first but little resistance.

Of one thing I feel almost certain, that bushes anchored with their branches pointed towards the source of a stream holding much earthy matter in suspension, will form banks at any points required, and these may be added to, annually, until they reach the highest water level.

In conclusion, I have the honor to observe, that the strand road has never been completed; that for a considerable distance it is too low, and is rendered lower annually by want of a sufficient number of culverts across it, to drain its surface water from

its inner edge: and that a great quantity of earth work is required to replace that which has been washed away at the parts protected this year, and at the several bridges over streams crossing the strand.

The best protection to the strand would be a line of well built ghats, and considering how the river is held in honor by the Hindoo portion of the population, and how important a good quay is to all the commercial people, I hope, that some of the wealthy inhabitants of the city of Agra may be induced to supply this desideratum at least partially.

In the meanwhile it will be advisable to plant the sloping bank, lately acquired by deposit from the stream, with jhow, as soon as it is left dry by the receding of the river; if this is done, three or four culverts built, and the road restored at the bridges, and at its eastern extremity, I think it will remain, much in the state to which it was originally brought, for many years to come, especially if timely petty repairs are made as occasion may require.

I have the honor to be, &c.

J. R. OLDFIELD, *Captain*,
Executive Engineer.

(LETTER DATED 30TH SEPTEMBER, 1848.)

FROM CAPTAIN J. R. OLDFIELD,
Executive Engineer, 10th Division.

TO THE SECRETARY TO THE LOCAL AGENTS AT AGRA.

SIR,

In sending you again the plan and estimate* submitted in December 1847 to the Local Agents at Agra, I have the honor to state that no portion of the ground gained during the rains of 1847, by protecting the bank of the strand with bushes, has been lost this year, and that the three short spaces filled up in the beginning of 1848 have had an excellent effect in widening the base of the strand, to admit of its being widened at top.

This base might have been easily widened still more, by putting the bushes further out, but I was anxious to preserve the wharf as well as the road, and therefore to keep comparatively deep-water along the strand, especially under the Fort.

This year the principal force of the stream has been thrown on the bank between stations marked *2 and *3 (in the plan),

* Omitted in print as not requisite.

and this portion consequently received further protection at the beginning of the rains.

At the point where the strand joins the Taj road, which was completely broken through, an excellent base has been obtained, now well above water, for restoring the communication above high-water mark.

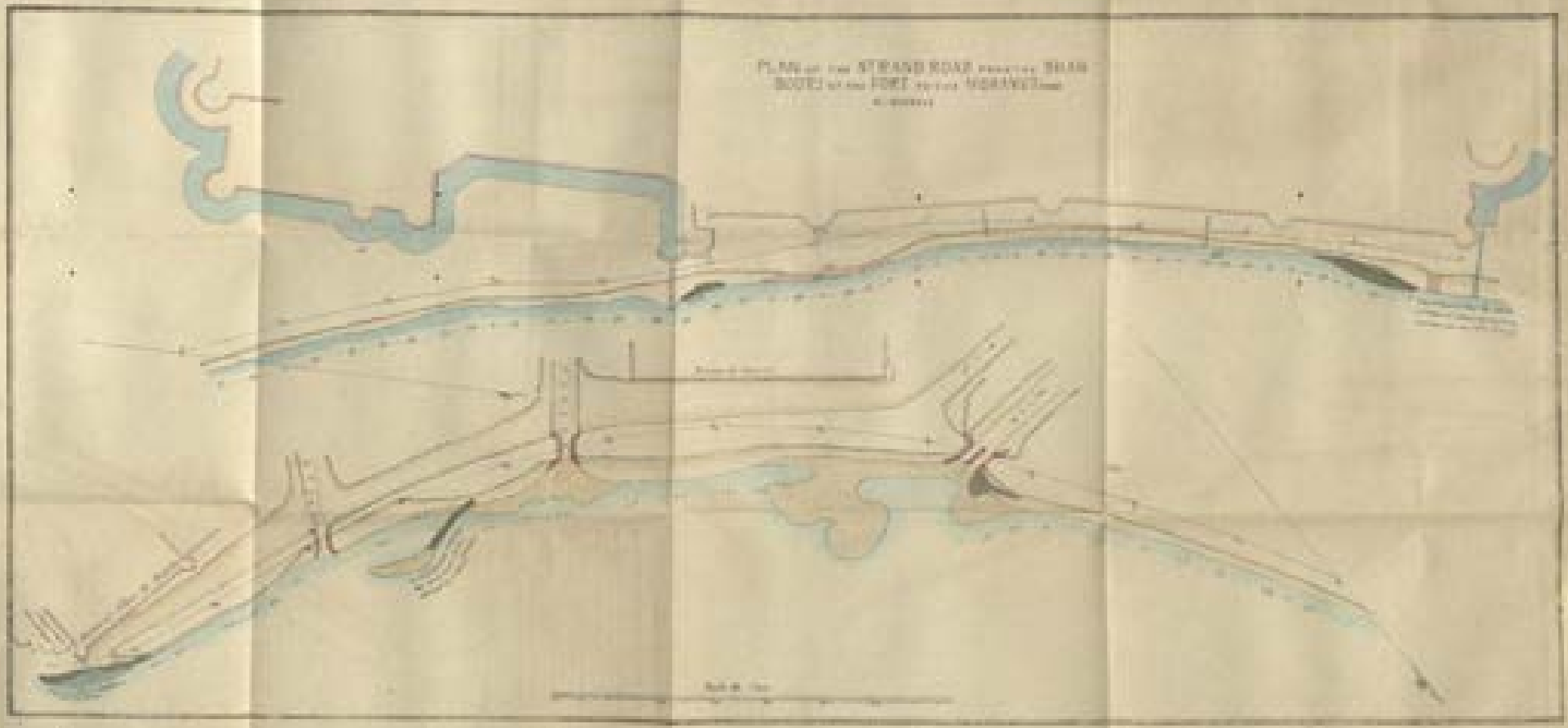
The importance of the strand and wharf, so far as it lies under tne Fort walls in a military point of view, led me to bring the subject under the consideration of the Superintending Engineer North Western Provinces, on the occasion of his visiting Agra lately, and under instructions from him, I am now preparing an estimate for raising and repairing the portion lying between *1 and *16.

The estimate, however, does not include a metalled road, which is left for furture consideration.

I have, &c.,

J. R. OLDFIELD, *Captain*,

Executive Engineer, 10*th Division*.



No. XXX.

REPORTS ON THE KHIRKEE AND CHUTTURPOOR BUNDS NEAR DEHLIE.

Report by MR. E. BATTIE, *in charge of Nujjuffgurh Jheel Works, dated 8th April*, 1848.

1. The remains of the numerous Bunds which are found in many parts of the Dehlie district, more particularly in the Southern Pergunnah, most convincingly attest the attention paid formerly to the subject of irrigation, and the great labor and expense incurred to secure it by means of these embankments.

2. Some of these Bunds owe their origin to the enterprise of village communities; some to the munificence of individuals; and others to the Native Governments, particularly the Patan dynasties, who have left some immense works of this description.

3. The Bunds are variously constructed; some being mere earthen embankments; others are massive structures of masonry, in the construction of which, neither labor nor expense has been spared.

4. The remains of 27 Bunds have been found, and it is supposed that many more exist. Some of these Bunds are of great extent. Amongst the most remarkable is that known as the KHIRKEE BUND. It is a very extensive work and constructed of massive pucka masonry. This work could not have cost less (at a rough calculation) than Rs. 1,10,000: assuming a moderate rate (for work) of the present time.

5. In the immediate vicinity of the present city of Dehlie, the remains of a most extensive work of this description, are still to be seen. It appears formerly to have connected the hills, near *Rohilla khan ke Suraee*, with the range that runs through the military cantonments, and ends near the river Jumna, about 2 miles north of the city. It is difficult, at this time, to ascertain the precise object for which this work was constructed, owing to the great changes caused by the formation of the Dehlie canal, and the consequent increase of gardens; to make room for which a great portion of this Bund has been destroyed.

6. The southern portion of the district, being divided into numerous valleys by the ranges of low hills which intersect it, is admirably adapted for works of this description, of which the cultivators formerly appear to have fully availed themselves.

7. The numerous ruins which are so profusely scattered over this part of this district, attest the presence, at some former period, of a much more numerous population than is at present to be found; and there can be little doubt, that instead of the present unproductive state, this part of the country was formerly well cultivated and fertile. It is with the hope of, in some measure, restoring this favorable state of things, that the re-establishment of some of these Bunds has been proposed.

8. The Khirkee Bund (which is stated to have been constructed by the Emperor Feroze Togluck, about the year A. D. 1365,) was first repaired by Mr. C. Grant, Collector of Dehlie, in 1841, who closed up the lower range of openings with planks and kurries, but owing to the great quantity of water upheld in the rains of 1843, the planks gave way. The openings were then closed with pucka masonry, by order of Mr. J. Lawrence, and the whole faced with earth, and a small sluice constructed. This measure appears to have been effective, with regard to the stoppage of the old sluices. No escape, however, appears to have been provided, after a sufficient quantity of water had been collected above the Bund. The consequence was its giving way at two places. The last of these failures was during the rains of 1846, since which the Bund has been repaired by Mr. A. A. Roberts, the Officiating Collector.

9. Some idea may be formed of the force with which the water comes down, when it is stated, that it burst through the pucka portion of the Bund, consisting of a wall 10 feet in thickness, and faced and backed with earth about 20 feet thick on each side. It should, however, be mentioned that the wall although intended to be pucka, is little better than so much rubble masonry: so badly are the stones cemented together. The soil is of such a light sandy nature, that great difficulty is experienced in keeping the Bund water-tight. A considerable quantity of water sometimes finds its way through the earthen embankments and pucka masonry, and springs up on the lower side of the Bund. During the month of August 1847, great apprehensions were entertained for the safety of the Bund, in consequence of a spring of this kind.

10. Since the repair of the breach of 1846, the Bund has stood, and the nullah, above and in front of the sluices, has in consequence filled up to a depth of nearly four feet, by the earth brought down and deposited by the floods.

11. One great fault exists in the whole of these Bunds, and which appears to have been the principal cause of the numerous failures, viz. no efficient *permanent* escape for surplus water hav-

ing been provided after a sufficient quantity has been retained. The water therefore rises higher than is necessary, and a greater quantity is accumulated than the embankments can bear. The consequence, is, the partial destruction of the Bund and the total loss of the water.

12. Some permanent escape for surplus water should be provided, as it is useless to expect a native chowkedar to exercise sufficient judgment, in opening sluices for this purpose, during heavy and continued falls of rain.

13. To rectify this defect with regard to the Khirkee Bund, the upper range of sluices or arches should be re-opened. They are seven in number, and would give sufficient water-way. It would, however, be necessary to construct a pucka over-fall or slope, in these arches, to adjust the surface of the upheld water to a point which would be ample for irrigation. Above this point the surplus water would have a free and permanent escape, as the upper portion of the arches would always remain open.

14. The water could be reduced by means of the sluice, when required; or, instead of a pucka slope, moveable planks might be fixed in the arches to the height required.

15. Irrigation to lands below the Bund might be attained by means of the sluice.

16. The force with which the water rushes through the old sluices of this Bund endangers the whole structure, as the bed of the nullah has been thus cut away immediately under the openings, and the foundations injured: indeed, cut away so much, that large masses of masonry, consisting of the whole lower facing of the sluices between the towers, have fallen into the bed of the nullah. The quantity of masonry, that has thus fallen, is very great, being nearly 20 feet in breadth at the centre of the sluices. The platform over the lower range of arches appears to have been originally 30 feet broad over the centre arch. It is now only about 10 feet; the remainder having fallen.

17. It will, therefore, be necessary to secure the foundations of the Bund, at this point, by the construction of a floor and slope of rubble masonry, consisting of the largest masses of stone procurable, to break the fall of the water from the upper openings, and to prevent any further cutting away of the bed of the nullah, or damage to the foundation of the Bund.

18. It will also be necessary to point the whole of the face of the lower range of sluices, and fill up the interstices of the masonry, to prevent the falling water displacing any more of the stones.

19. That portion of the Bund, situated between the sluices and the village of Khirkee, must be considerably strengthened with earth-work, both on the upper and lower sides.

20. The Chutterpoor Bund is an earthen embankment of considerable extent being nearly 2 miles in length. It appears to have been

originally constructed by the village communities in the neighbourhood. It would, if properly completed, irrigate upwards of 1850 beegahs of land above the Bund. Irrigation might also be given to the lands lying below the Bund, and to the right and left of the main nullah, by the construction of two pucka outlets, to the right and left of the sluice.

21. The Bund would require a new sluice, (the present one being quite insufficient) the planks of which should be adjusted, so as to act as a permanent escape. The Bund will also require completing for 2,450 feet, and some additional earth-work to strengthen the places where it has formerly given way in 1845.

22. The Bund was first repaired in 1843 by Mr. M. Gubbins and by Mr. J. Lawrence in 1844. In 1845 this embankment gave way, and was afterwards repaired by Mr. A. A. Roberts, Officiating Collector, who also ordered the construction of the sluices. The Bund stood the rains of 1847; no great quantity of water was, however, collected.

E. BATTIE,
In charge Nujjuffgurh Jheel Works.

INSPECTION REPORT BY MAJOR P. T. CAUTLEY, (BENGAL ARTILLERY), SUPERINTENDENT GENERAL OF CANALS, DATED DECEMBER 18, 1848.

KHIRKEE BUND,

(Three Miles East of Kootub Minar.)

1. Mr. Battie in his report dated Dehlie, 8th April 1848, has most fully and satisfactorily described this work. It is certainly one of very great interest, and from the style of architecture of the buildings attached, must appertain to a period, considerably before that of the Moghul conquest.

2. The position of the Khirkee Bund, is eastward of the Kootub. The Bund itself has its left flank resting on a low line of rock, and its right terminates on what appears to have been a portion of an old fortified wall. The total length is about three miles. Its section is very considerable. On its whole length it is covered with the detritus of old walls and buildings; and the village of Khirkee, which occupies an ancient and very extensive Mosque, is situated at a short distance from the main sluices of the dam, and on the top of the embankment. These main sluices are well

described by Mr. Battie. They consist of seven openings, flanked by massive towers. These openings have, in former days, been regulated by shutters, as is attested by the sites of windlasses, grooves, and holes pierced for the chains or ropes with which the shutters were worked. The whole building is of that massive order, which characterizes all the buildings of the Puthan period in the neighbourhood of Dehlie. Time has had little effect upon the building, but the retrogression of levels upon the tail of the work, arising from the great rush of water through the sluices, and the rapid slope of country upon which the dam is situated, has formed a step of many feet from the original to that of the present surface of the country on the lower side; the consequence has been that the lower side of the building has fallen down, and is in fact going to ruin. The great difference of level, moreover, that exists now, between the surface of the country, on the upper and that on the lower side of the dam, has led to an evil of the greatest magnitude—*videlicet*, a series of springs, and an inclination of the pressure of head water on the upper side, to force itself under the embankment; and in fact to blow up the main body of sluices, which are situated at the point, where this action is going on under the most exaggerated circumstances.

3. The breaches that have taken place since 1841, and which are referred to by Mr. Battie, have clearly originated from this cause. The Bund has not been overtopped by the water, but partly from the rotten nature of the old embankment, and partly from the causes above noted, the Bund has burst. The last breakage that took place has done considerable injury, in wearing away the soil at the tail of the Bund, and extending the deep hollow, (which formerly only existed immediately below the masonry sluices) along the alignment of the embankment to some distance. These breaks have only taken place between the main sluices and the old Mosque, in which the village of Khirkee is. As far as I can see, it is this line only, extending to about 1,032 feet, that requires our particular attention. I may here mention that this Bund, in its whole length, appears to have been *backed* by a massive demi-revetment of stone. Why this revetment should not have been placed in front instead of in the rear, does not appear to me to be clear.

4. In my letters to Mr. Battie's address No. 2015 and 2087, of the 17th and 27th April last, although I agreed with Mr. Battie on his projected repairs, I looked with much doubt and uncertainty as to the possibility of giving an efficient repair to the old sluices; the fall of water being 30 feet or thereabouts; the building itself being a ruin; and actions of the subsprings tending in every way to weaken the structure. My inspection of this work has still further corroborated my former doubts on the subject, and I have no hesitation in saying that it would be most dangerous, and moreover most expensive to attempt any repair or alteration to this old ruin.

The situation, in which it is placed, has become, from the retrogression of levels on its tail, the weakest on the whole line of enbankment, and I therefore consider that we must relieve it from any other duty; we must strengthen its front by a long talus of well rammed and puddled earth, and look to means of escape elsewhere.

5. The plan that I have proposed to Mr. Battie, is appended.

1*st*. A well rammed slope, base 4, and height 1, to be laid in front of the dam, from the mosque to the east flank of the ancient sluices; this slope to protect all that portion of the work which has been subjected to breakage, and which portion is *de facto* the weak part of the dam. The slope ought to be covered with grass and turf.

2*nd*. To construct, at the points *A* and *B* (*vide Sketch No.* 2,) weirs or flush escapes of masonry, 50 feet in clear width each; the sill or wasteboard of each to be on a level with the required *high-water* mark in the reservoir.

3*rd*. At *C* and *D*, to build irrigation drains, to act as escapes, and at the same time to provide the means of irrigation to the fields below the dam; the level of the sill or wasteboard of these irrigation drains, to be on a level with the required *low-water* mark of the reservoir.

The cost of this will be, in approximation,

No. 1	Earthwork 10,00,000 Cubic Feet @ 2-8,	2,500	0 0
,, 2	Weirs, ...	2,000	0 0
,, 3	Irrigation drains, ...	200	0 0
	Total Rupees, ..	4,700	0 0

I have requested Mr. Battie to draw up an estimate, in detail, in the usual form for the above work.

6. It would be advisable annually to give a careful repair to the embankment, especially to that portion in front of which I have recommended the talus. It would also be beneficial, as opportunity offered, to extend the rear slopes, so that they may ultimately be 3 base to 1 perpendicular. I would not interfere with the young neem trees, which are growing in such abundance on the slopes between the mosque and the sluices. They would give a magazine of material for fascine making in the event of future leakage through the lower parts of the embankment, although in the projected additional slope, most of these trees would be buried.

7. It appears to me that if the proposed works are carried out, very considerable benefit will be effected, and the objects of the dam itself practically brought into action. The advantage of the open weirs on each flank, is, that, immediately the surface of the reservoir rises above the maximum required height, the superfluous water will escape over a wide surface, without the aid or influence of any chowkedar or establishment. From the irrigation heads, cuts would be made (*vide Sketch No.* 3,) on approved

levels, so as to embrace and give a command over a quantity of cultivation. The tail of these cuts would fall into the main line of escape. The irrigation heads would require shutters, and the superintendence of a chowkedar who would open them immediately, it became necessary, to lower the level of the reservoir, below the maximum height, as retained by the sill of the weirs.

8. Should Mr. Battie be allowed to put this project into execution, I would suggest that he should be called upon to examine the line of valley below this Khirkee Bund, as the escape water from the Khirkee Bund might be retained again, to the great advantage of other tracts of arable land; it is probable that other ancient works exist south of Khirkee, which by a trifling repair, might be brought into use; at any rate, should the Khirkee Bund repair be authorized, to the extent recommended in this letter, I would recommend that Mr. Battie's attention be directed to converting the whole line of this valley into an irrigation tract, as far as means for collecting rain water may shew themselves.

9. When I visited the Bund on the 9th current, the prospects of the rubbee crop, (wheat) on the upper, or that side of the Bund which had been inundated, were good; the appearance of the whole country was, as far as the eye could reach, green and beautiful. In the opposite direction, or on the lower side of the Bund, the prospect was quite reversed. With the exception of a few patches watered from wells, the whole country was dry and parched up. This would certainly not be the case under the project of irrigation drains above noted.

CHUTTURPOOR BUND,

(Three Miles South of the Kootub Minar.)

This work has been fully described by Mr. Battie, in his report, dated 8th April 1848. It is situated about three miles due south of the Kootub, across the upper portion of the valley of the drainage of the Badshahpoor nullah. The Bund consists of an earthen embankment merely; neither sluices nor revetment; with the exception of one masonry escape, 10 feet in width situated near the centre of the Bund, which is furnished with a shutter, windlass, &c. This work is roughly built of stone, and from its site being near the centre of the work, and therefore in the deepest part of the channel, there is a considerable retrogression of level upon its tail; so much retrogression, in fact, that unless immediate steps are taken for its protection, the work must inevitably sustain serious injury, during the next rains.

2. During the late season, the quantity of rain which has fallen, has been very small; so small, in fact, that the sluice does not appear to have been used: but even under this disadvantage it is remarkable, to see the difference of the crops above and below the dam. Above, a sheet of green wheat and other rubbee crops, as far as the influence of the dam, and its inundated land had extended. Below, nothing but brown, barren, broken country. To those who doubt the advantages of canals and irrigation, I would strongly recommend a visit and walk along the line of one of these embankments. On one side, there are irrigation and verdure; on the other side, there are dryness and drought; and this comes so directly under the eye at once, that the impression is marvellously satisfactory.

3. It strikes me that this Chutturpoor Bund is a work that might well be taken up by the Government, to be placed in perfect repair, and act as a pattern for others hereafter. The system that I would recommend is precisely that described for the Khirkee Bund. The principle being this, 1st, that the centre portion of the enbankment being the highest, and consequently that most liable to accident, ought to remain intact and be strengthened and protected in every possible way; 2nd, that, the escape of superfluous water, or water which rises above that point required for inundation, ought to pass over weirs, free and open, unimpeded by gates, and not dependent on establishment for regulation; that these weirs should be situated, one in the neighbourhood of each flank, or rather at points, as far distant from the centre, as may be considered less liable to lead to retrogression at the tail; that the width of the weirs ought to be great, so as to admit of a comparatively quiet passage of the water over them; 3rd, that, whereas the sills or wasteboards of the weirs are on a level with the *high-water mark*, or that level required for inundation, each flank of the embankment ought to have an irrigation drain, the sill of which is on a level with the *low-water mark*. These irrigation heads ought to be connected with Rajbuhas or watercourses, carried along on a proper level, and embracing all the country below the dam, in the fashion shewn in the *Sketch No. 3*.

4. From the date, therefore, that it was considered necessary to reduce the water from its maximum height for inundation, these irrigation drains would be opened, and the water would be carried off by channels, so as to afford irrigation to the land below the embankment. If necessary, of course, these irrigation heads might be opened at an earlier period; but in common and average seasons, the plan would be that described above; the weirs retaining the water for the purpose of inundation, and the irrigation heads providing the means of reducing the water in the reservoir to its lowest required height, and at the same time distributing its benefits to the country below the Bund.

5. The present state of the Chutturpoor Bund is as follows :

1*st*. The Bund, or embankment, is perfect on its whole line, but it requires I imagine extension on its east flanks.

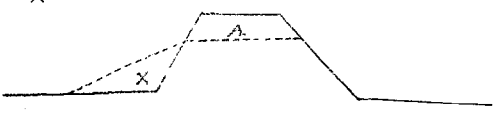
2*nd*. The cross sections vary in their dimensions very considerably, at points where, in former years, fractures have taken place. The front or interior slopes, have in those repairs been extended, but the general character of the section is a want of slope; portions of the Bund offer a nearly perpendicular wall to the front; and, generally speaking, the whole of the slopes require reforming.

3*rd*. The height of the embankment is exceedingly irregular, and it has apparently been determined on no true line of level; the flanks terminate abruptly on the country, at a height of from 4 to 6 feet above the surface of the earth.

4*th*. The masonry outlet is built in an awkward position; there is at present a perpendicular descent, at the tail, of about 7 feet, arising from retrogression of levels. To repair this a considerable outlay will be required. The plan of this sluice is to retain the water to its maximum height for inundation by a gate, and when the country requires relief from inundation, the gate being opened, the water runs off *to waste*, passing down the lowest channel of the valley.

6. The proposed improvements are as follows: supposing that *Sketch No.* 4, represents the cross section of the valley with the embankment across it,—Mr. Battie would find out the maximum height to which the inundation reached, and at this point, he would build a bench-mark, as at *A*. This bench-mark would be on a flank, and in front of the Bund. He would then carry out a line of levels, cross the valley and construct another bench-mark at *A*, the two bench-marks being on one exact level. A line drawn from the top of one bench-mark to the top of the other, would give a zero, upon which operations would be carried. This zero line would also give the level of the sill or wasteboard of the weirs.

7. The true top of the embankment would then be laid out, at a height of 36 inches above zero on the whole line of the work; and from my observations it strikes me that much earth would be procured for forming the front slopes of the Bund, by materials taken from the top, as represented below. The earth removed from *A*, in reducing the height of bank, to be thrown, at X



E

8. The general rule for the slopes ought to be thus—
Front or interior slopes 4 to 1 perpendicular,
Rear or exterior slopes 3 to 1 perpendicular,
and the whole of the slopes turfed, covered with grass, and kept clear from trees. At the foot of the exterior slope, however, I would recommend a belt of quick growing trees, to be used as material for fascines in cases of emergency; neem, bukoin, franse, would do well for this purpose; and I would suggest an experiment of planting jao or tamarisk, which would be a most useful species of material if its growth were successful. The section of the Bund, on my project, would be as shown in *Sketch No. 5*, supposing the height to be 10 feet.

9. The weirs would be exactly the same as those proposed for the Khirkee dam; the width of passage for the water, being reduced to 40 feet, and the height of flank walls to 3 feet. The sluice now existing would be broken up, and the material would be used in the new works.

10. The irrigation drains would be similar in every respect to those projected for the Khirkee dam.

11. The cost of the masonry works will be, in approximation,

2 Weirs,	2,000	0 0
2 Irrigation drains,	200	0 0
Total Rupees,	2,200	0 0

That of the earth-work cannot be determined without accurate survey, but the Government might be relieved from the expense of this by the use of convicts.

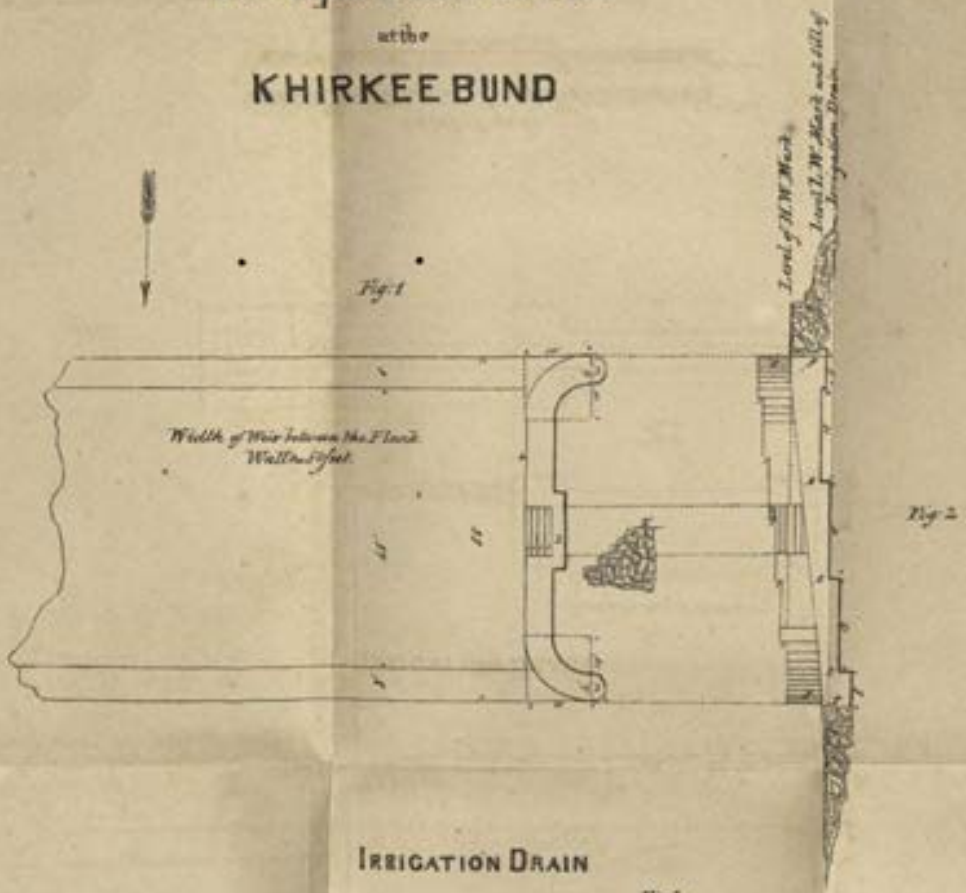
12. I have requested Mr. Battie immediately that he can spare time, to encamp near the Chutturpoor Bund, build the bench-marks, described in the 7th paragraph of this letter, and take accurate levels, so as to give the points for the sills of masonry works, and the height of the embankment. When this is done, estimates shall be submitted in due form to the Government.

No 1

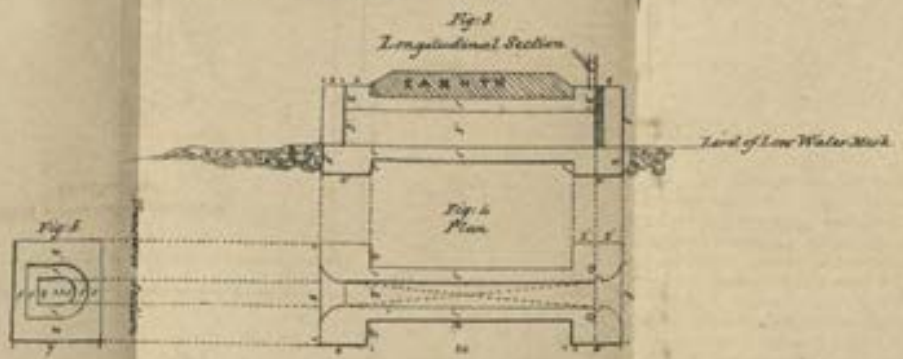
Escape Dam or Weir

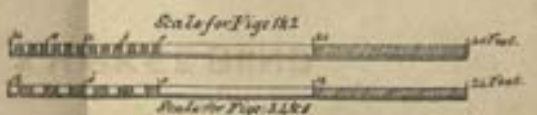
at the

KHIRKEE BUND



IRRIGATION DRAIN

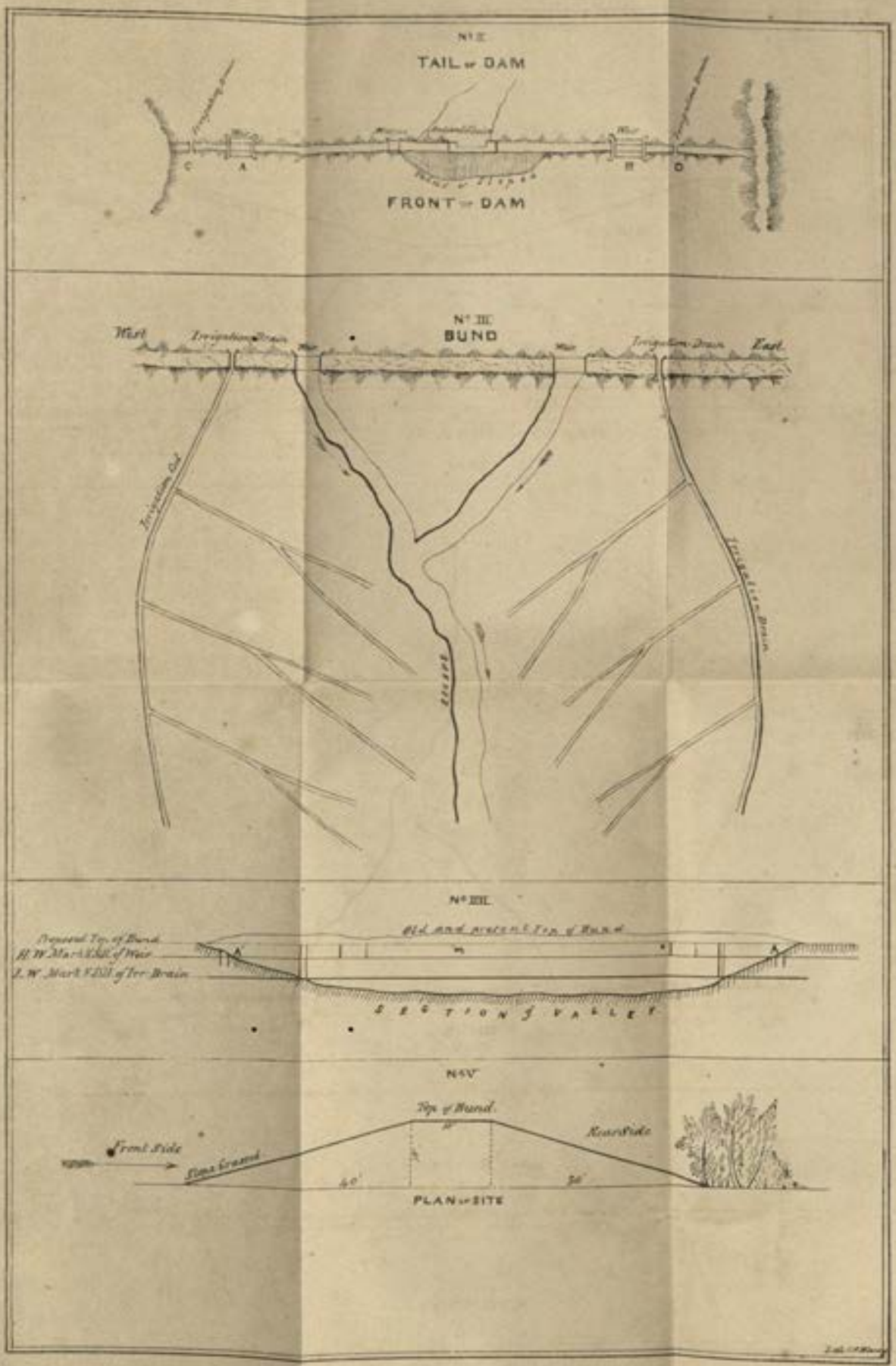




P.S. The height of the openings of the Irrigation Drain will depend upon the actual difference of Level between the Top of the Embankment and the Level of Low Water Mark. The Sketch only shews 6 feet, any additional height must be added to that of the Piers. E.G. the Piers above are 2 feet high, should the difference of Level between the Top of the Bank and Low Water Mark be 8 instead of 6 feet, the Piers will be 4 feet high.

Signed P.T. Cautley Major
Supdt Canals N.W.P.

Lith C.A.Bs


N° II
TAIL of DAM
FRONT of DAM
N° III
BUND
West
Irrigation Drain
Irrigation Drain
East
Irrigation Cut
Irrigation Drain
N° III
Proposed Top of Bund
H.W. Mark 4 Feet of Weir
L.W. Mark 5 Feet of Irr. Drain
Old and present Top of Bund
SECTION of VALLEY
N° V
Top of Mound.
Front Side
Rear Side
Stone Ground
40'
30'
PLAN of SITE

No. XXXI.

SETTLEMENT OF PERGUNNAH KURNAUL, ZILLAH PANEEPUT.

I.—Extract Paras: 27th, 28th, 29th, 30th, 31st, 32nd, and 33rd, of a Letter No. 3277 of 1845, dated the 31st of July, 1845.

From J. THORNTON, Esquire,

Secy. to the Govt., N. W. P. Agra, Rev. Dept.

To H. M. ELLIOT, Esquire,

Secy. to the Sudder Board of Rev., N. W. P., Agra.

Dated Agra, the 31st of July, 1845.

Paneeput District.—*Para.* 27. Mr. Edmonstone's report on this district is very complete, as far as it goes, and highly creditable to his intelligence and judgment. Experience has justified the soundness of his measures, and it is believed, that the district is now in a most flourishing condition.

28. The proceedings are however incomplete, so far as they do not embrace the large istumraree of the Kurnaul Munduls, in the north-east of the district. It is understood that the villages constituting this estate had their boundaries marked out, and were prepared for survey, but that the survey was never effected. In marching from Kurnaul to Kythul, the Lieutenant Governor was much struck, with the poorness and bad management, of a great part of this estate, and had many communications with the Munduls on this subject.

29. It is well known, that this estate was given to the family by Lord Lake, in exchange for a jagheer, they held in the Moozuffernuggur district, at a time when it was part of the British policy, to leave the country to the west of the Jumna, as much as possible, under native management. The estate is large and valuable, whilst the permanent quit rent, with which it is charged, is trifling. The Munduls are understood to have been already great gainers by the exchange, whilst by good management, the value may be very greatly improved. The villages are British territory, subject to our laws, in all branches of the administration.

30. It is very doubtful, if any circumstances justify the Government, in leaving subordinate proprietors at the mercy of an assignee of the Government revenue, without interfering to define and record the rights of all parties. When the inhabitants are subject to our Police, and to our Civil Courts, such occasional interference cannot be avoided: it may be claimed by any party and at any time. If security of property, and substitution of law and order for uncertainty and misrule, are the effects of the present mode of recording rights in the Revenue Department, and those effects are found to be beneficial in khalisch estates, they will be equally or much more so, in jagheer or istumraree estates.

31. Circumstances in this case, however, particularly bind the Government to interfere. The lands were assigned by this Government, who are therefore bound to come forward, and provide that no wrong is inflicted, by the act of assignment, which resulted from the policy of the day. There are no old established and doubtful claims, of proprietary right to investigate. The village communities remain in all their integrity, the unquestioned owners of the soil, and often able to resist by physical strength, even the just demand of their superiors. If, by our Police, we deprive them of the benefit of their strength, we are bound to substitute, for their innate means of resistance, the protection of legal arbitration.

32. A memorandum on this subject was prepared at the time, and communicated to the Munduls, and a copy of it is appended to this letter for the Board's information. The Munduls did not very strongly object to the measure. They were apprehensive that it might curtail their influence and consideration, though they perceived that it might augment their income. The measure ought not to rest on their approval or rejection, and the Lieutenant Governor is fully convinced that justice and sound policy alike demand its execution. The Board are accordingly desired to give effect to it, though they are of course at liberty to state any objections they may entertain, and these will receive due consideration. The Revenue Officers of Paneeput for the time being, are invested with the necessary powers, under Regulation VII. 1822, to complete the operation.

33. It may be noticed, that the late occupation of Kythul, by the British Government, and the survey of that district, which is now nearly concluded, afford peculiar facilities for preparing these istumraree villages, for settlement. They form the connecting link between Kythul, and the present surveyed portion of Paneeput. Captain S. Abbott, at present in charge of Kythul survey, will have instructions to send his surveyors into these villages, as soon as they can be spared, and the Collector of Paneeput will be careful to have the boundary marks renewed by the time when the survey can commence.

II.—MEMORANDUM REFERRED TO IN PARA. 32 OF GOVERNMENT ORDER, DATED 31ST JULY, 1845.

Heads of a proposed arrangement for the better administration of the Tract of Land, near Kurnaul, assigned to the Munduls.

1. The rights of the Government in this tract, were assigned to the Munduls, for a settled quit rent, which can never be raised.

2. The Munduls have now held the tract, for about 40 years.

3. The cultivation is still scanty, the inhabitants are poor, subsist mostly by pasturage, and are of turbulent and thievish propensities.

4. The Munduls realize their just dues with great difficulty, and are unable to improve the estate, which the Government has conferred on them.

5. These evils and difficulties, arise from insecurity of title, and want of authoritative definition of rights.

6. They can never be remedied, by the ordinary operation of the Civil Courts; because there is no process, or form of proceeding, applicable to the case.

7. They can be remedied, by the course prescribed in Regulations VII. 1822, and IX. 1825.

8. It is the duty of Government, to put into operation the powers it possesses.

First.—For the protection of the rights of the village communities, imperilled by their assignment of the territory.

Second.—To assure the Munduls, the full value of the grant made to them.

Third.—To promote the improvement of the country, and reclamation of the people, from immoral habits. The mode in which the object may be attained, is easy.

9. The boundaries of existing villages, should be marked off, as nearly as they can be ascertained.

10. The whole should be surveyed, according to the scientific, and native methods.

11. A fair jumma should be fixed, for the next 30 years, on the inhabited villages.

12. The relation in which the Munduls will stand, to the proprietors of these villages, is explained in para. 112, of Directions for Settlement Officers.

EXTRACT PARA. 112. "The inferior owners are thence-"forward bound to pay their revenue to their superiors ac-"cording to fixed instalments, which should be regulated, so "as to be a month in advance of the Government instalment. "So long as they pay regularly, they cannot be ousted. If

"they do not pay, on demand of the talookdar, he may "either distrain their personal property, or sue them, sum- "marily, and on obtaining a * decree it will be in his option "either to bring the property to sale, "or to hold it kham, under authority "from the Collector, till the balance is "liquidated, with interest at the rate of "one per cent. per mensem. In either "case, the defaulters forfeit their pro- "prietary rights, permanently, or for a time, and become mere cul- "tivators of their seer land, on fixed rates, under the purchaser or "the talookdar."

* See Clauses 6 and 7, Section 15, Regulation VII. 1799, Section 32, Regulation XXVIII. of 1803, and Act VIII. of 1835.

13. If there are any villages brought into cultivation, by the Munduls, since the land was assigned them, these will be entirely theirs.

14. In such villages, there will be no rights, but those derived from the Munduls.

15. In the old inhabited, and now settled villages, the rights of all inhabitants must be determined, and recorded, as in khalseh villages.

16. The advantage to the village proprietors, will be the acquisition of a valuable property, which will afford them the means of comfortable and honest livelihood, and will prove a stimulus to industry.

17. The advantage to the Munduls will be, the acquisition of a certain fixed income, capable of easy realization, and the means of greatly increasing their future income.

18. The benefit to the Government will be, the cultivation of the country, and the improvement and enrichment of the people.

19. The rights of the different members, of the Mundul's family, in the whole tolooqua, should be declared and recorded, as well as any partition of the estate, they may have made amongst themselves.

20. The Government will bear the expense of the scientific survey. The village khusreh survey and record of village rights, should be made at the expense of the Munduls, or village communities. The former, because the security of their income will depend upon it; the latter, because the stability of their rights, will rest on it.

J. THORNTON,
Secy. to Govt., N. W. P.

III.—Letter No. 434 A.

From the COLLECTOR of Paneeput,

To the COMMISSIONER of Delhie.

Dated Camp, Israna, 30th November, 1847.

Sir,

I have the honor to submit to you, herewith, the settlement papers, as per margin,* for pergunnah Kurnaul, which have been completed agreeably to the instructions of the Honorable the Lieutenant Governor, dated 10th January 1845.

1. 2 Vols. of Village Survey Maps, and 1 Pergunnah Map.
2. 1 Vol. of Village Statements Nos. II and III.
3. General Statements No. IV.
4. Annual Jumma Statement No. V.
5. Police Statement.
6. List of Mafee Cases.

2. I propose to divide my report into sections, the first containing general remarks, on the local peculiarities of the pergunnah, on its inhabitants, and the Mundul isturnrardars; the second detailing the mode in which the instructions of the Lieutenant Governor have been carried out in bringing these proceedings to a close.

SECTION FIRST.

Part 1st.

3. Pergunnah Kurnaul.—The pergunnah of Kurnaul, as formerly constituted, contained 221 villages: when we became possessed of a portion of it in 1805, Rai Sadasook was sent there as tehseeldar. He reported that of the 221,

218 {
14 had been long annexed to pergunnah Azeemabad.
5 were in the possessions of the Seikhs.
25 had been long in the possession of the Hunjpoora Nuwab.
7 had been granted to the son of the Koonjpoora Nuwab.
95 were considered uncultivated and uninhabited.
63 paying Revenue to the British Government.
*9 were since (1816) discovered by Mr. William Fraser to be in possession of the Seikhs, &c., and being resumed by Government, were incorporated with pergunnah Paneeput.

4. Boundaries.—The pergunnah of Kurnaul, as at present constituted, comprizes the 95 uninhabited, and 63 inhabited mouzahs, abovementioned, and is bounded, on the east, by the Jumna, on the south by the pergunnahs Paneeput Khadir and Bangur, and on the west and north by the Kythul, and Ladwa districts, inter-

* These appear to have been omitted.

mingled towards the north, with the independent states Shamgurh, Thanaisur and Hoorajpoora, which latter has also lands, lying eastward, along the Jumna.

5. ROADS.—The roads from Delhi to Umballah, as also that from Meerut to Umballah, pass through Kurnaul; and now since the last campaign, a direct road from Kurnaul to Ferozepoor, is in process of construction. The cross road from Rohtuc and Bhewanee through Keesung in the Nurduk to Mutoollah, has also become of some importance.

6. NUMBER OF MOUZAHS.—The pergunnah contains 94 distinct estates, two of these have been separated since the survey, and of the whole 94,—82 are inhabited, and 12 are uninhabited.* There is however no mouzah in which there is not some cultivation; no less than 64 deserted Khairuhs are to be counted, within the limits of these estates, and though it is not to be supposed, that they were ever, all at the same time, inhabited, it is a proof of the capabilities of the country, in a state not much differing from its present.

* Aheepoor.
Boodhunpoor.
Bhojepoor.
Jiglalfal.
Jurrowtee.
Khaksoree.
Ooplee.
Saorie.
Shaikhoopoor.
Jahurpoor.
Therwa,
Zureefa,

7. EXTENT.—It contains 178,761 acres, of which 6,241 are considered barren by the Revenue Surveyor, and 53,146 cultivated, leaving 101,491 fit for cultivation. The relative proportions of cultivation, and culturable, are consequently one-third, and two-thirds.

8. FORMER STATE AS COMPARED WITH PRESENT.—Mr. William Fraser in a report dated 15th November 1816, states, that when this tract of country was given to the Mundul Nuwabs, 63 villages paid revenue to Government or were inhabited, and that four-fifths of the extent of the pergunnah, was overrun with forest. We may hence estimate the improvement which has taken place during the last 40 years, to be the bringing under cultivation, of about one-eighth of the extent of the pergunnah, and reinhabiting 18 villages. Were I however to hazard an opinion, founded on my own local observations, and enquiries, I should say, that a much smaller proportion than one-fifth of the whole area, was under cultivation in 1805; and that it would be a fairer estimate, to consider the original cultivation as an eighth of the whole, and the improvement, one-fifth.

9. PRESENT STATE AS COMPARED WITH OTHER SETTLED BRITISH PERGUNNAHS ADJOINING.—In order, more easily to compare the state of the pergunnah, with that of the other better known portions of the Paneeput district, I have divided it into two parts; calling them Kurnaul Khadir and Bangur, and thus establishing the former, with the other two Khadir districts, and the latter with the two Bangur.

The proportions of cultivation are as follows:

	Cultivated per cent.	*Culturable per cent.*
Kurnaul Khadir, ...	87½	112½
Paneeput ditto, ...	57	43
Soneput ditto, ...	55	45
Kurnaul Bangur, ...	32	70
Paneeput ditto, ...	65	35
Soneput ditto, ...	84	16

It here appears that Kurnaul Khadir, is by far the most highly cultivated portion of this district, and Kurnaul Bangur, the least cultivated. There being this great difference between them, I will consider them apart, in proceeding with their statistical details.

PART 2ND.

10. KHADIR LAND.—The Khadir lands of Kurnaul are of small extent, being intercepted by a part of the Paneeput pergunnah, and a tract belonging to the Hoonjpoora Nuwab. The soil is light and sandy, but very productive. I have seen irrigated bhoor produce crops of safflower; indeed it is customary to mix safflower with gram. Branches of the Jumna, which fill only when the river is at its height, intersect this tract, which is little used in the khurreef: but produces wheat, barley, gram, safflower, tobacco, and garden stuff, in the rubbee harvest.

11. EXTENT.—Its area is 16,322 acres, of which 872 are barren, and 13,291 are cultivated.

12. IRRIGATION.—The per centage of irrigation is very great, viz. 65 per cent. which arises from several causes.

First.—The small depth at which water is found, averaging from 4 to 13 cubits (6 to 20 feet).

Second.—The great strength of the underground springs; among the wells which were examined, I found one, which only lost 3 feet of water, between morning and evening, though 2 Rehuts each with 3 yoke of oxen, were at work all day. Two and three feet may be considered the average loss with one Rehut applied with 3 yoke of oxen.

Third.—The nature of the soil, which permits the use of cutcha wells.

13. WELLS.—These wells are easily made, their sides are protected by bundles of surcumda grass, or by wattles of the tamarisk or bansa tree; they last only one season, being dug when the rains have entirely ceased, and the autumn harvest is housed, and sinking in with the full rise of the Jumna, in the rains. They cost almost 10 rupees each.

14. A pucka well costs from 100 to 130 rupees, but will last any number of years, and may be worked with two or more Rehuts at a time, if the supply of water be ample.

15. WATER WHEELS, ARHUT OR REHUT.—These water wheels are peculiar to this district, and as I find that Mr. Edmonstone has not given any description of them; I think the observations I have made, regarding them, may not be uninteresting.

16. The machinery is most rude; 3 uprights support a forked trunk of a tree, some 18 feet long, at about 6½ feet from the ground; within the diameter, covered by this, a pair of bullocks turn an upright axle, which carrying a large lantern wheel, the yoke, and a sort of cradle in which the driver sits, is supported at its upper end, by the trunk, and forms the centre of the machine.

17. A horizontal axle passing under the bullock walk, carries at the one end, a crown wheel, connected with and driven by the lantern wheel above mentioned. The other end of the axle is supported over the mouth of the well, and carries a wheel with an endless rope, and about 30 to 60 baked earthen waterpots. This wheel is so constructed, as to appear hollow, the spokes being placed away towards the centre of the well, so as to leave room for a hollowed date tree trough, to receive the water as it is poured out while the machine is in motion.

18. There is not a particle of iron used in the whole machinery, and it costs the cultivator from 7 to 10 rupees.

19. When I was Collector of Goorgaon, in 1839, having heard of this system of irrigation, as possessing great advantages, when water is to be found at small depths, I had one of these water wheels constructed at Soneput and set it up at a village in the Lohmuh valley; the people did not however take to it, for purposes of irrigation; I was therefore in doubt as to its advantages, over the more generally adopted method of Lao churrus, and having lately made numerous, and minute enquiries, the following are, as far as I have been able to ascertain, their respective merits.

20. THEIR ADVANTAGES.—The *Lao churrus** can be worked, at any depth, while the wheel cannot be used with this primative machinery at a greater depth than 15 cubits or 22½ feet: an average† Lao churrus may be said to irrigate 15 acres, ditto ditto *Rehut* may be said to irrigate 12½ acres.

21. To work the churrus properly, 4 pair of oxen are required and 4 men;—2 pair ply the well till 12 o'clock, and are then relieved. The oxen require to be strong, averaging from 30 to 50 rupees a-piece. With this complement the well may be worked for 5 pehars.

* That is the common system, in which the water is brought up in a leather bag.

† The highest average for irrigation given by any of my informants, was for a Lao churrus 21 acres, Rehut 17.

22. To work the Rehut 5 pehars, 3 pair of tolerably good oxen, or 4 pair of inferior cattle, are required, besides 2 men and a boy.

23. The relative monthly expense of the two systems of irrigation, may be computed as follows:

Lao churrus.					*Rehut.*				
8 bullocks, ∴	@	3½	....	28	6 bullocks,	@	3	....	18
4 men, ...	@	3	....	12	2 men, ...	@	3	....	6
1 boy, ...	@	1½	....	1½	1 boy, ...	@	1½	....	1½
			Rs.	41½				Rs.	25½

Difference 16, which multiplied for the number of months, by 4½=72.

24. Supposing the produce per acre to be in wheat, 18 maunds,* realizing a net price of 35 seers per rupee, and in straw a third of the above, we have 20-9 for the grain, and 6-13 for straw, total 27-6 per acre, or 68-7 per 2½ acres, which is the difference between the surface-irrigation powers.

The product of the Lao is agreed to be greater than that of the Rehuts; this arises, less from difference in the irrigation, than from the greater strength of the Bangur lands, where alone Laos are used; the difference has been computed at a maund per acre, or 12½ maunds, 14 rupees, 6 annas. But this is more than counterbalanced, by the expenses of manuring, ploughing, and sowing the 2½ acres, which I calculate at 20 rupees.

25. By the above calculation, the Rehut has the advantage by almost 10 rupees.† I do not, however, think, that in practice, it is at all the cheaper mode of irrigation. The natives prefer it, where they are accustomed to both, but I consider the reason of this, to be almost solely arising from—

First. The great saving of human exertion. [This in England would entirely determine the question of cost, but here, where human labour is so cheap, it does not do so:] and *secondly*, and chiefly, the fact that inferior cattle, of all descriptions, may be used for this work. This enables the cultivator to commence work with less capital, at a time when the khurreef kists being due, and

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* This estimate has been formed on the highest scale, both as regards expense and produce.

† This estimate has been framed on the highest scale, both as regards expense and produce, and in working out the comparison, I have made use of the following data. Seed corn 10 seers to pucka beegah, expense of ploughing for wheat 4 rupees per ditto.

N. B.—1 rupee sufficient for khurreef crop; bullocks cost on an average 3 to 4 rupees each per mensem.

Koomars or hired labourers, are paid at Kurnaul, by giving them as autumn harvest, 6 maunds of mukee, 6 maunds jooar; at spring harvest 6 maunds of wheat, 6 maunds of chunnah; they also receive supper, when they return home after work, and five seers at the harvest, for assistance in housing.

the produce probably in hand, (besides the seed corn, with the ordinary expense of the rubbee ploughings, to be paid for,) ready money is not to be had on easy terms. I have been told, that the constant turning round in the circle shortens the lives of the animals. But I have not been able to ascertain the fact, and as it is the practice, to change the yoke every pehar or three hours, I should not conceive such to be the case, where the cattle were properly used.

26. THEIR ORIGIN.—The people can give no account of the introduction of the water-wheel. Constructed as it is by the commonest village carpenter, it stands alone, as a type of knowledge, superior to what is now to be found among the natives of this country.

27. I have made enquiries, to ascertain whether it might have been introduced from Cabul and Afghanistan, by the Mussulman conquerors, but I do not find that such machines are required in that country. In the Punjaub they are, and much larger than here, though as far as I can learn, on exactly the same construction. In Egypt the principle is generally so far modified, that the periphery of the water-wheel, is formed into compartments, though in the Pasha's gardens, the endless rope is used.

28. I am, however, inclined to attribute its introduction, to the Italians, who attended the Courts, of the different Mogul Emperors; as the wheel, with its endless rope, is very generally used in the gardens of Italy, wherever irrigation is necessary. I feel strengthened in this view; by finding among the ruined gardens of Delhie, along the northern road, the same hydrostatic principle of carrying water, under the level of the road in masonry conduits which is so common in Italy, and by the fact that the wheel is not in use in any part of the south of Delhie, where the Mewaut tribes were always in a state of revolt, while it is so thoroughly introduced, towards the north.

PART 3RD.

29. BANGUR LANDS.—Kurnaul Bangur offers the greatest contrast to the Khadir, by its small cultivation, and large extent of jungle villages, having part of their lands in the one, and part in the other, such as Ghurmada, Jerowlee, &c., which have the whole of the Khadir under cultivation and well-irrigation, while the whole of the Bangur lies waste.

30. EXTENT.—Its area is 162,439 acres, of which 5,369 are barren, 43,301 cultivated, and the remainder 113,769 form the extensive grazing grounds, of the murdnk, which increase in wildness of unreclaimed waste, as we advance west-ward towards Asendh and Kythul, where cultivation may be said to be at its minimum. The soil of this tract is almost entirely Rouslee and Chuknoul.

31. IRRIGATION.—Irrigation from wells is small, viz. 3,651 or $2\frac{1}{4}$ per cent. on the cultivation; the depth at which water is found varies from 20 to 100 feet, gradually and regularly increasing, with the distance from the Jumna khadir.

32. STREAMS.—It is traversed by various streams. The first, in importance, is the Delhie Canal, which passes at a short distance from the Jumna khadir, affording irrigation to 20 villages. The next is the Chutung Nuddee which only flows during the rains. It passes by the large Ramghur villages of Buras, Nusung, and Dachose (whose high sites testify their antiquity) and continues its course in the Osendh pergunnah.

33. A smaller stream, the Nye, passes by Kochwa, Pehwut, Padha and Goendur, ending in two branches, at the two last named villages. There are besides, one or two Watercourses, but not of sufficient importance, to have received a name.

34. The Chutung and Nye would both admit of being bunded, and would thus be the means of fertilizing a large tract of country, but divided as this pergunnah has been, among the different branches of the Mundul family, without regard to contiguity of tenure, I have very little hope of such an undertaking being commenced on, by mutual consent and concession, unless the Government were to take very decided measures, regarding it. *See Appendix No.* 1.

35. REMARKABLE TRADITION.—There is a tradition, in the country, that the Chutung used to flow, during the whole of the year, and that it ceased in the reign of Alumgeer; since which time, it is said, the prosperity of the country has gradually declined, and the level of the under-ground springs, so far sunk, that no water is to be found in any of the old wells.

36. It is difficult to account for this tradition which is attested and perhaps kept alive, by the existence of these old wells—*now dry*. I have been unable to discover the remains of any old bunds, which might have been the means of supplying the country with water; otherwise it might have been supposed, that during the reign of that royal bigot this part of the country (which proving part of the sacred limits of Thanaisur, is considered most holy by all Hindoos) might have been visited by the most especial marks of his displeasure, and such sources of local wealth, and prosperity destroyed.

37. The only supposition I can advance, is, that at that time the Sirsootee joined its waters to the Chutung, above Thanaisur, and that such supposition is not altogether groundless, I would refer to Ferishta, who states, that in the A. H. 587 or A. D. 1191, Mohuneea Ghowery was defeated, by the Rajahs of Delhie and Ajmere, at the village of Serouree, on the banks

of the Sirsootee, fourteen miles from Thanaisur, and eighty from Delhie.

This is the exact position, where the Chutung now crosses the Umballah road, and the village is now called Terowlee.

38. SLOPE OF THE COUNTRY.—The natural level of the country slopes down towards the west; so that the torrent might be expected, in the lapse of centuries, to work its course further in that direction.

This westward slope commences so close to the present valley of the Jumna or Khadir tract, that part of the drainage of the Kurnaul cantonment lands is carried in that direction.

39. RICE CULTIVATION.—These streams, passing through, and losing themselves in the district, cause a very considerable amount of rice cultivation, and we find it acres 10,603 of 45,152, or nearly one-fourth, (23¾ per cent).

40. There is one peculiarity about the cultivation of rice, which is worthy of notice. The ground is not ploughed at all; water is let into the field, which is surrounded by high substantial douls, and when the surface is thoroughly softened, to a sufficient depth, cattle are driven over and over the fields, for three successive days, so as to work up the whole surface into deep mud, the field all the while being covered with about 6 inches depth of water.

On the third day, about 12 o'clock, the moment the cattle leave the field, the seed is sown, broad cast, (from 7 to 10 seers per cutcha beegah) and settling in the water, is soon covered with the sediment, which has been stirred up by the trampling of the cattle. This is the method adopted for all coarse rice, as I have gathered from the cultivators themselves.

41. I had previously enquired, from persons in the upper classes, and was informed that the cattle were used, to trample the seed into the ground, after it had been thoroughly saturated with water.

Had this account proved correct, it would have more fully borne out the truth of the account, given by Herodotus, Book Euterpe, Cap. XIV, where he relates, that "the Egyptians have no occasion for the instruments of agriculture which are used in other countries." But that, "as soon as the river Nile returns to its "bed, after the annual inundation, each man scatters the seed over "his ground, and driving swine over it, to tread the grain into the "ground, waits patiently for the harvest." The practice, as above detailed, bears sufficient resemblaance to the account given us, by the historian, to exonerate him from the accusation of having invented it.

42. STAPLE PRODUCE.—The staple produce is rice, cotton, joar, sugar-cane, sunn, laneemount, and other small pulse, for the autumn; and at the spring harvest, wheat, barley and gram.

PART 4TH.

Khadir and Bangur Resumed.

43. POPULATION.—The population of the pergunnah amounts to 37,409, or 134 per square mile; 9,667 are Mahomedans, and 27,742 are Hindoos. The average cultivation per male adult, is $3\frac{3}{4}$ acres.

44. The different parts of the pergunnah are so very differently populated, that I have divided the whole into three districts:

I. The Khadir Khass, comprising 9 villages and 7,519 acres, has 267 inhabitants to the square mile, and $4\frac{1}{2}$ acres of cultivation per male adult.

II. The 21 canal villages and those partly Bangur, partly Khadir, including Kurnal Qusbeh—37,477 acres; have 314 inhabitants to the square mile, and $2\frac{1}{2}$ acres of cultivation per male adult.

III. The 64 Bangur Muduk villages 133,765 acres, have 77 inhabitants per square mile, and 574 acres of cultivation per male adult.

The inhabitants of the two first divisions are generally orderly and well behaved, good cultivators. Those of the third division are for the most part notorious for cattle-stealing, and general lawlessness, and only surpassed by the inhabitants of Asendh, Khythul and the neighbouring Seikh states.

45. CASTE.—The 82 villages are inhabited as follows:

Moosulmans.		*Hindoos.*							
Ranghurs.	Rajpoots.	Rajpore.	Rorees.	Jat.	Goojur.	Guddee.	Byragee.	Brahmin.	Mixed.
18	14	1	20	13	4	3	2	3	4

The three principal tribes are the Jats, the Rorees, and the Ranghurs, the two former are Hindoos and are considered excellent cultivators.

The latter are partly Hindoos and partly Moosulman, averse to all settled government, and ready to join in any expedition of robbery or theft.

They are unwilling cultivators, delighting in the possession of extensive jungle grazing grounds, where they can secrete and pasture their stolen herds.

46. Most of the villages have small square fortresses, with bastions built of pucka bricks, in which the inhabitants can take refuge, when assailed by a force, with which they cannot cope. These were all erected previous to the British rule, and except where the Mundul istumrardars have occupied, and repaired them, for their own use, they are gradually falling into decay.

47. The following is a table, shewing the extent of the holdings of each of these three castes, with the per centage of cultivation as compared with the total area. The result cannot accurately represent the habits of each, because in the contiguous villages, there is of course much Paee-kast, which tends to equalize the amount of cultivation in each mouzah; but it will give an approximation.

TABLE.

CASES.	*Extent of holding.*	*Per centage of cultivation.*	*Cultivation per Male adult.*	*A du. Male population.*
Jats, ...	16578	52½	6½	1322
Korees, ...	21067	36	4	1915
Ranghurs and Rajpoots,	94287	29	5½	5066

48. EDUCATION.—Education is at a very low ebb. In the part of the country, where cultivation is protected to so small an extent, it is not to be supposed, that much learning will be found. In Qusbeh Kurnaul itself, there are, of course, several schools, and a large portion of the inhabitants, Buniahs, Kayuths, Mahomedans, are severally so far conversant with the arts of reading and writing, as to enable them to pursue their different occupations, and employments. Few, if any, are able to read both characters. There are 13 schools where Persian is taught, and Arabic read; and 5 where the Nagree is used.

49. There is one Persian school at Joondla, a place formerly the abode of wealthy Mahomedan families, now decayed or decaying. The chowdrees of the pergunnah, who receive an allowance from the Munduls, reside still in this village, where are to be found several persons who can write the Persian character, and at Dachore there is one individual. All Buniahs are more or less instructed in a corruption of the Nagree character, such as is used for writing accounts, and besides these, perhaps 30 persons of the cultivating classes might be found able to sign their name, and write something that would serve as a memorandum to themselves, and such as were well acquainted with their hand-writing.

50. MARTS AND TRADE.—The only mart is Kurnaul. Here reside the principal merchants through whom the local traffic is carried on. I learn from them that the principal exports are towards Umballah. These consist chiefly of grain and pulse of every description, partly the produce of the district, and partly what is collected from the neighbouring Dooab, also cleaned cotton, tobacco, ghee, and vegetable oils, as well as sugar, and native cloths. Sambhur salt is imported for consumption, and passes on towards Umballah, while Lahoree salt passes downwards: and almonds and fruits and safflower, are imported from the Umballah side.

51. PRICES.—Articles of common comsumption of food bear rather higher prices in this pergunnah than in the rest of the Delhie territory lying southward. This arises from the position of the large military force creating a demand towards the north west. The following table shows the average price of the principal articles for the present year, as well as an average for the preceding ten years: the figures showing the number of seers per rupee.

YEAR.	Wheat.	Barley.	Rice.	Joar.	Gram.	Ghee.	Cotton.
1846-47,	29· 9	33· 6	12· 8	23· 2½	28· 13½	3· 1	6 8
1835-36,	26· 5	37· 13	12· 0	2½· 8	29· 5	2· 12	5. 6½

52. RELIGIOUS SHRINES AND FESTIVALS.—There are no places of pilgrimage, besides those of mere local fame. Boolee Kullundur has a cenotaph at Kurnaul, but in far inferior estimation to that at Paneeput. At Boodhakhairah, on the Saharunpoor road, is another Moosulman shrine, where several fairs are held annually: and at Buras, a third shrine is endowed with the revenues of 313 acres for its maintenance. All these shrines are freely resorted to both by Muhomedans and Hindoos. As the pergunnah forms part of the esteemed neighbourhood of Thanaisur, the Hindoos have several sacred tanks, which are resorted to on annual occasions, as well as during eclipses. The most reputed, is that of Parasur near Buhlolepoor, where several thousands are said occasionally to congregate.

PART 5TH—TENURES.

53. ISTUMRAREE TENURE.—I commence this subject with an account of the Mundul family, and their istumraree tenure. They are by origin Moola Jats, converted to Muhomedanism, and the family appears to have originally settled at Samanas, in the protected Seikh country.

54. Shreeooddeen Khan Nuwab, in the year 1780, obtained from Nuwab Mujeedoodowlah, *Jaidad* grant, of the purgunnahs of Moozuffernuggur, Suroor, and Chirtawul, on condition of furnishing, for Government service, 200 horsemen fully equipped; and on his death in 1789, the grant was continued to his brother, Mohumdee Khan, by Mujuraj Dowlut Rao Scindia.

55. When we came into possession of the whole of this part of the country, we found Mohumdee Khan in possession of this jaidad, and in pursuance of the Government policy of that day, he was desired to submit an estimate of one year's rental, of his jaidad estates, with a view to his being transferred to the west of the Jumna.

56. It is supposed that the Nuwab imagined, that by submitting a rental much below the truth, Government might be induced to abandon this design in order to avail themselves of the 200 horse, at so small a cost; he therefore stated his estates to be worth 32,000 rupees per annum; whereas it appears from a letter of Mr. Guthrie, the then Collector of Saharunpoor, dated 17th February 1806, that the real revenues were

Moozuffurneggur,	Rs.	35,000
Suroor,	,,	15,000
Chirtawul,	,,	15,000
Rupees,		65,000

57. Mohumdee Khan had, besides these, a jagheer in the same vicinity, worth Rs. 5,000 per annum.

58. The Mundul family, of which he was the head, were induced to relinquish their jaidad in the Dooab, for that part of pergunnah Kurnaul, which the British Government still retained to itself. This was given to Mohumdee Khan, Ghyrut Ali Khan, and Ishak Khan, in jaidad for their life time, as per grant, (*See Appendix No. 27,*) dated 24th March, 1806, signed by Lord Lake.

59. The chiefs, however, finding that the British Government were in a liberal mood, sued for a continuance of the jaidad to their heirs; and obtained a second grant (*Appendix No.* 3) in istumraree, or quit rent, of Rs. 15,000 per annum, with the reservation of custom dues, rent-free lands, villages previously held in jagheer, religious donations, and daily pensions. This grant also bears Lord Lake's signature, and is dated 9th April, 1806.

60. Under the authority of these grants, the Mundul chiefs were put in possession of the fort, and dependencies of Kurnaul, on the 15th July 1806, and their descendants continued in possession, paying to Government the fixed quit rent Rs. 15,000.

61. It appears that during the few succeeding years, there arose dissensions among the three Munduls, regarding the right of Mohumdee Khan, to be considered the head of the house.

For I find Sir Charles Metcalfe, in a letter dated 11th June 1812 reprobates the quarrel; declares Mohumdee Khan to be the head, and in granting compensation for the serai, and lower fort, (which Government have found it necessary to occupy,) apportions Rs. 2,000 to Mohumdee Khan, and Rs. 1,000 to each of the other parties.

62. The family has meanwhile found it expedient to separate their shares, and a deed of partition bearing Mr. Seton's signature, and dated 16th July 1807, specifies their respective shares to be

Mohumdee Khan.		Ghyrut Ali Khan.		Ishak Khan.
Rs. 15,000 of which		Rs. 13,000 of which		Rs. 12,000
as chief	as share	Personal expenses.	as share	
3,000	12,000	667	12,333	

63. I have made out (*See Appendix No.* 4,) a genealogical table, shewing the degree of relationship which exists between these parties, and their descendants* who are besides yet more intimately connected, by innumerable intermarriages, chiefly arising from a custom which they say is peculiar to their race, viz., of never giving any of their daughters in marriage, save to a Mundul chief. The consequence is, that contrary to all Moossulman and natural law, they oblige many of their females to lead an unmarried life. This custom I am (May 20th) trying to induce them to give up, as it is merely an unworthy device, to increase the family possessions, and the means of their own immediate gratifications, but I have no great hopes of success.

64. BISWAHDAREE TENURES.†—They are for the most part bhyachara; the equal sub-division of land among the male children, naturally leads to this state of tenure, and where the zumeendaree

* Their respective shares according to the new or proposed Assamees will be

Mohumdee Khan and Ahmud Allee Khan.	Ghyrut Allee Khan now Gholam Shurreef Khan.	Ishak Khan now Ruheem Allee Khan, Mohumed Allee Khan, Shumshare Allee Khan.
Rs 33,756	Rs. 31,423	Rs. 34,097

† Of the Biswahour Mouzahs constituting the Pergunnah, 15 are held by the istumrardars, 6 are zumeendaree, and 73 are bhyachara.

forms the exception, it arises from the recent settlement of new villages, and the granting of the biswahdaree right to the istumrardars, agreeably to the Hon'ble Lieutenant Governor's Minute, dated 10th January 1845.

65. There are here as in the other parts of the Delhie territory, the 3rd class of resident cultivators, viz., the *biswahdar*; the *mouroosee* or hereditary cultivator: and the tenant at will, or *paeekast*; their respective rights have been so fully reported on as well by myself, as by many others, my predecessors, that I do not think it necessary here again to enter into details.

66. To a person only acquainted with the local usages of the dense population of the Dooab, and other central provinces, those of this pergunnah must appear most strange. The difference is however only the necessary consequence of the want of population and the small value of land which the possessors are not sufficiently numerous to manage.

67. Hence we find that there is not a single biswah in the whole pergunnah, in which the lands have been divided; the rights are either held in common by the whole village, or acknowledged to belong in equal shares to each Panla, though at present the holdings may be unequal.

68. Below the Panna, or Thola, all record of ancestral right appears to be lost, and each holder of cultivation is supposed to have a right to a proportional quantity of the uncultivated area. Thus it has been recorded by every bhyachara community.

69. The most curious custom, regarding the division of biswah, which I have met with in the Delhie territory was found at Kaunla, a Khadir village, possessing wells sufficient to irrigate its whole cultivation. Here the lands of each Panna were redistributed either every year, or every few years, each holder possessing a different field, with every fresh distribution. As however the continuance of such a custom, would in a great degree render nugatory the present records of settlement, they have now made a permanent division, which is not to be disturbed in future.

70. I have mentioned that the istumraree grant expressly excepts villages previously held in jagheer. These are, as per margin,* four in number. The three forts are held by religious communities;—Seetamudh by a mehnut elected from among the Jankimie Byragees; Wysree by a mehnut elected from among the Neemaundee Byragees; and Buhlolepore, where the previously mentioned holy tank Parason is situated, was held in equal halves by a mehnut elected from among the Gunaishpooree Goshaens, and one chosen from among the Ramanundee Byragees. The latter are however dispossessed by the istumrardar Gholam Shureef Khan, who holds the estates under mortgage.

Villages previously granted in Jagheer.
1. Seetamudh.
2. Wysree.
3. Golee.
4. Buhlolepoor.

71. In all these communities the mehnut has a life tenure only; at his death a new mehnut is elected by a conclave of the faqeers of that particular denomination. The revenues are administered by the mehnut alone, for the good of the shrine and of the particular sect of religious mendicants to which it belongs. Food is daily distributed. A more detailed precis of the peculiarities of each community, will be found in the settlement record of the mouzah.

72. RENT-FREE LANDS.—These are of very small extent, amounting in the total to 774 acres, of which 313 are held by the Khadims of the Moossulman's shrine, at Buras. In investigating these claims, I have been careful not to disturb any tenure, which the Munduls wished upheld; those only whose rights they questioned, have been looked into; the rest have been definitely recorded, to be either for the life-tenure of the present holder, or in perpetuity.

POSTSCRIPT TO SECTION 1ST.

Though Criminal Statistics do not properly come within the limits of a settlement report, yet as the lawless state of the inhabitants was one chief cause of the determination of Government, to interfere with the system of management, hitherto adopted, by the Munduls, I have not deemed it irrelevent to append two tables, *(See Appendix A.)* shewing the proportion committed by each tribe, during three different periods of five years, and further to elucidate this subject, I have drawn a comparison between this pergunnah, and other countries, the data for which I have extracted from *Speed's Criminal Statistics of Bengal.* The details necessary to complete the entries, I have extracted from the Government records at considerable trouble, and I regret to find, that the results do not satisfactorily represent the extent of crime committed: it is now too late to compile others.

I do not consider (Table I.) the small amount of convictions which appear in the first period, 1820·25 as any proof that the country was then more tranquil, or the people more moral, but only, that at that time a much more lax supervision was kept up. The European Officers being fewer, and the establishment less effective, consequently a much larger portion of criminals escaped punishment.

The latter period 1842-46 shews lower results, than that intermediate, on account of the removal of the large Military force, formerly stationed at Kurnaul.

As regards Table II. in which is entered the average per annum, for the aggregate three periods, I have simply to observe, that the numerous petty offences committed by the miscellaneous inhabitants of Kurnaul, and its cantonments, swell the per centage of the whole pergunnah beyond that of the village tribes.

SECTION 2ND.

73. I now intend detailing the manner in which I have carried into effect, the Hon'ble the Lieutenant Governor's instructions, regarding the settlement of the pergunnah, and other matters; The first step being,—.

(PART 1ST.)

The Settlement of Boundaries.

74. This had been commenced on, by my predecessor before my taking charge of the districts, in April 1845. It proved to be a far more troublesome business than I had anticipated. In pergunnahs now held by istumrardars, but paying revenue to government, the biswahdars are the sole litigants. Here however the different Mundul chiefs, found their interests deeply at stake, and supported their people with money, advice, and occasionally armed retainers.

75. To give some idea of the extent to which the boundary litigation has been carried, I mention the case of Phooluk Badshapoor, which was first decided by Sheosuhae Ameen, in 1822, under orders of the Dewanny Court. The decision being upset on appeal, was never acted on, and the boundary, though repeatedly marked out, remained undetermined, and disputed, till my ultimate decision, which was upheld on appeal at the close of 1845.

76. All the boundaries were settled and defined, by substantial marks, before the arrival of the Revenue Surveyor's establishment, in November 1845. I had not a single complaint from the Surveyor, on this head.

77. SURVEY.—Captain Abbott, in consultation with me, agreed to keep the supervision of the Ameens, in his own hands, making over the papers when completed, to me, for *Pertaul*. Captain Abbott knew more of the Ameens, and the manner in which they had previously worked, on other more scattered parts of the country, and because being the first cold weather I had passed in this district, it was very desirable for me to move about in every direction, and become acquainted with every part of it.

78. Hardly however had the native Surveyors commenced, when the Seikh campaign began. I was directed to remain at Kurnaul, and Captain Abbott was engaged in Military duties.

79. Captain Abbott intending and expecting to return immediately, kept his camp standing in the neighbourhood. Being aware of this and gathering therefrom, that I might expect him at his post, at any time, I did not think it advisable to interfere with that part of the duty, which he had undertaken to perform. The revenue professional survey operations, were meanwhile carried on by Mr. Foy; and I proceed, as directed by you, (No. 64, dated 13th January 1847,) to record my opinion of their accuracy.

80. PROFESSIONAL SURVEY.—The maps are very neatly executed, but I have found them less correct than I expected, as regards roads and courses of nullahs.

In one or two villages, I found small patches of cultivation inserted, where none existed, while rarely, if ever, did I find that cultivation had been left out, and great pains appear to me to have been taken, to omit nothing; and this task has been the more laborious, on account of the immense extents of jungle land and the easily overlooked sites of detached rice cultivation.

81. You will perceive, in all the survey maps furnished by Captain Abbott, that there are two entries of cultivation; the one apparently recorded in the Surveyor's Office, the other in Captain Abbott's own hand-writing: the two almost always differing, in every detail, though agreeing in the total area measurement.

82. I naturally supposed that the latter, being a rectification by Captain Abbott, was the more to be relied on, but having found that in several instances, the former was nearer the truth, I referred to himself, and was informed that his revision of area, was chiefly founded on the khusreh results, which he had depended on, imagining that they had been sufficiently scrutinized and tested in pertaul.

83. The khusrehs, having since this been found to be incorrect, a source of error exists in Captain Abbot's revision, which renders it necessary to adopt, in preference, the data furnished from his office.

84. I have found this, almost invariably, a very correct return of cultivation, so much so, that I could almost always tell from it, whether the Ameen's work was over or undermeasured. A correctly measured khusreh, would average from 10 to 5 per cent less than the professional results.

85. I have received from Captain Abbott every assistance which was in his power to give.

86. PERTAUL.—Being myself obliged to remain at Kurnaul, in consequence of the hostilities on the N. W. Frontier, Ram Surn Dass, the Deputy Collector at Delhie, was sent by you in March 1846, to take charge of the current duties of the Settlement Office, and I directed him to examine, and test the measurements as they were finished, and given in.

However on my return from the Hills, in the ensuing November, I found it necessary, as reported at length in my letters Nos. 93 and 103, dated 18th and 25th March 1847, respectively, to go over again myself the whole of this business.

87. I felt that it was a particular hardship, on the Ameens, to have their work repertauled, and thrown on their hands, a year after they had done it. I therefore took every precaution, that nothing should be rejected but what was inadmissible. This was the more necessary, because the pertaul had to be made in the ab-

sence of the Ameen. I have often been obliged, myself, to make a shujreh, shewing each separate plot, or dubra, and then when I returned home, by copying out fair, and adjusting each field by measurements, I have at length, putting together 3 plots here, 2 there, and 4 in a third place, been able to follow out in some degree, the measurements which the Ameen had made before me; but I seldom found, when all this trouble had been taken, that in the end I could pass the work, which, so difficult for a European to trace out, must have remained an enigma to a native.

88. The partial shujrehs, were not however useless, for long after the heat of the season had obliged me to forego camp life, I have been able to recognize, and re-examine by means of them the measurements which have been since made by the Ameens.

89. No pains have been spared in the completion of this troublesome and monotonous duty. Every village in the pergunnah has been pertauled at least once, either by myself or the Officiating Joint Magistrate Mr. Ogilvy; many of them have been pertauled twice, and three times, in consequence of the repeated inaccuracies of the Ameens: and I beg leave to bring to your notice, the assistance which Mr. Ogilvy has rendered me in this particular.

90. NATIVE MEASUREMENT PAPERS.—The khusrehs and shujrehs have thus given me the greatest trouble. The Ameens employed, are, in my opinion, a decidedly worse set, than any I have previously met, attached to a Revenue Survey. They may have been, at first, emboldened by the want of supervision, and the lax pertaul under Ram Surn Dass, but my opinions have been fixed by what I have since seen, where several villages have been measured three and four times over, before I could pass them. Thus delaying this part of the settlement investigations, until April 1847.

91. The first, and very obvious cause of bad measurement, is, that they never have with them, chain bearers, (mirdahs) accustomed to the work; I find that in order to save themselves expense they have invariably made use of chummars and other low caste kumans, taken from the village, whose cultivation was being measured, and who had never handled a chain before.

92. But besides this, I have found them try all manner of tricks; for instance an Ameen, after measuring very passably, the middle of the village, would guess at the contents of the frontier fields, and put them down hap-hazard.

93. In Machwa, where a second measurement had been found requisite, the Ameen, knowing me to be in the neighbourhood left the place, and did not send in his papers for a month and a half, trusting that I should be away, and that the heat of the weather would prevent my examining the further portions of the area. Being however well aware of the sort of person I had to deal with, I pitched a tent in the extreme boundary, and sleeping there, was able to examine the lands thoroughly, and return to Kurnaul before

the heat of the day commenced. I found the half next Kurnaul, extremely well done; while in the other half, there was not one single field, out of about 30 examined, which was recognizable in the shujreh.

94. Another source of error, was the different lengths of chain used. Provided the Revenue Surveyor had furnished it originally, nothing further was considered requisite; it might have broken 20 times, and been mended hap-hazard by a village blacksmith, but yet it was still "Sirkaree Jureeb," and could not be wrong.

95. Some Ameens could not draw the shujrah at all, and after making out the khusreh, would, as I am informed, go to some friend, and, get him to construct a shujrah, to match to the best of his ability. Such was Modee, the shujrah representing a very regular square, with the village in the centre. The professional map was a scaline triangle.

96. Again it has been the practice, for one clever Ameen to run through several estates, making a good shujrah of each, leaving the khusrehs to be filled up by idle or incompetent men. Thus where I have been led by the appearance of the field map, to expect every thing right, the measurements have often proved quite erroneous.

97. On the other hand some men to save themselves the trouble, had clubbed 20 and 30 fields together; though the crops they bore at the time, were different, and they were held by different owners.

98. With such a set of Ameens, it was impossible to be too careful.

PART 2ND.

99. ASSESSMENT.—In my attempt to frame a fair and moderate assessment, I have had to contend with several peculiarities. Where khalsa pergunnahs are revised, the Settlement Officer can consult the records of former years, and gather these from, not only the demands, collections and balances, of former years, but also the concomitant results of revenue administration, which always form a sure index, as to the expediency of adhering to, or differing from, the previous demands.

100. MUNDUL'S FORMER COLLECTIONS.—I have been unable to procure, from the Mundul chiefs, any record of this kind, on which I could place reliance. They have each given in a statement of 10 years' alleged collections, but I have not found that I could depend on the accuracy of the entries. This is most particularly the case, with Ghulam Shurf Khan, who has, I believe, nearly doubled his receipt in his statement. *(See Appendix No. 5.)*

101. Moreover, had I been able to gather the exact truth from them, I could not have used the results, thus obtained, as a guide

in my own decision; for I find, that they used to manage many of the Khadir and adjacent villages, as if they were, themselves, either the farmers, or proprietors of the soil; advancing money for wells, and bullocks, and taking care that no part of the cultivation should remain unoccupied during the season. Hence their receipts would include, not only the Government due or land tax, but also the profits of a proprietor. Thus in Dougurmuzra, (which half in istumrar and half khalisa is given in farm to the istumrardar,) the dues, as collected by Kun Buttae, or appraisement, are expected to amount to a far larger sum than the present Government demand, which the biswahdars were exceedingly anxious to be allowed to engage for.

102. On the other hand, the strong villages of the Muduk were able, by combining together, to make their own terms; and of course paid less revenue than might have been justly demanded of them.

103. Thus, it will be seen, in comparing the proposed jumma, with the records of previous collections, that in general the Khadir villages have been reduced, and the Muduk villages increased.

104. MUNDUL'S MODE OF COLLECTIONS.—In some few villages, as per margin,* a fixed lease, specifying a certain amount of money, had been given, but the usual mode of collecting, was by appraisement of the crops; the istumrardar's share varying from a fourth, in newly reclaimed lands, to a third, two-fifths, and even a half, in the richer and more productive lands. Otherwise zillah rates, as per annexed form, were in use.

* Khaklore, Jumalpoor, Kymla, Pehwunt, Sydpoora.

	Sugarcane.	Cotton.	Tobacco and Garlick.	Chunee.	Mukee.	Cheena.	Carrot.	
Khadir, ...	6 0 0	8 6 0	3 12 0	1 0 0	2 4 0	1 0 0	1 8 0	Per beegah.
Bangur, ...	0 0 0	2 7 0	3 0 0	1 0 0	1 8 0	0 15 0	1 8 0	

105. The furnishing Khemeed or green corn for the Nuwab's horses in the spring, was always a favourite stipulation, in the Canal and Khadir villages. In fact, every kind of produce, which was required for the consumption, of the family of the istumrardars, as well as their stables, elephants, and cattle, has been customarily furnished, from the villages.

106. MUNDUL'S ESTIMATE.—I had called on the Mundul chiefs, to prepare a doul or estimate, of their respective estates, giving the amount of revenue, at which in their opinion each village

should be assessed, together with an abstract, of the grounds of assessment. Their ideas on the point however turned out to be so preposterous that I did not reap much advantage from it. *(See Appendix No. 6.)*

I forwarded these original papers, for your inspection, more however as a curiosity, than a record. It will be seen, that Gholam Shurf's doul, is generally, double my proposed jumma.

107. RATES AND ASSESSMENT OF ADJOINING PERGUNNAH.—It is always a matter of first instance, to assimilate the Government demand, of every district, to those of the surrounding pergunnahs; Khadir and Bangur to the south, and Asendh, Kythul, and Ladwa to the north and west.

108. The two former were settled by Mr. Edmonstone in 1842; who mentions in his report, that his rates per acre were—

	Paneeput Khadir.	Paneeput Bangur.
Irrigated land,	2 10 0	2 12 0 Canal. 2 6 0 Well.
Dakur and Rouslee unirrigated,	1 5 0	1 6 6
Bhoor,	1 0 0	1 0 0
Culturable waste,	0 6 0	0 2 0

and I find by clubbing together average villages of that settlement adjoining this pergunnah, that I get general rates, on malgoozaree, and cultivation as follows. *(See Appendix No. 7.)*

	Malgoozaree.	Cultivation.
Paneeput Khadir,	1 6 1 10	2 8 0
Land Bangur,	1 4 0	2 8 0
Simple Bangur,	0 8 0	2 0 0

109. Regarding the Asendh, Kythul, and Ladwa pergunnahs Captain Abbott, the district officer, kindly furnished me, (March, 1847,) with the rough statistical details of all those villages, which had been as yet measured, and assessed. The average rates of simple Bangur villages, which I have deduced therefrom, are 0-3-1 on malgoozaree, and 1-2-6 per acre, on cultivation. Between this, and the Paneeput rates, there is a vast difference, the one being less than half the other.

110. I am not exactly aware of the reasons, which have induced Captain Abbott, to assess his district so low, except that the people are most lawless; that the cultivation is only a sixth part of the culturable, or malgoozaree area: and that no attempt to reclaim

the inhabitants, and the land, could be successful without a fixed, and very moderate assessment.

111. Many villagers have, to my knowledge, removed from their previous holdings, in Paneeput and Kurnaul, to the Asendh and Kythul pergunnahs, in consequence of this new settlement. But not to such an extent, as yet to cause difficulty, in realizing the Government revenue, in Paneeput, where the population is more dense; and I have endeavoured, as far as lay in my power, to provide against its effects, on this pergunnah.

112. RATES.—I have, therefore, not attempted to deduce my revenue rates, from any calculation of produce, but have rather endeavoured, to adjust the revenue of the pergunnah, according to the peculiar geographical position it occupies; on the same principle though, on a somewhat larger scale, that a Collector would avoid any striking contrast, between one mouzah and those surrounding it.

113. I have adopted three different systems of rates, for the different parts of the pergunnah.

	Khadir villages.			Canal villages.			Bangur villages.		
Irrigated { Canal,	0	0	0	2	8	0	0	0	0
Irrigated { Well,	2	8	0	2	8	0	2	8	0
Dehur or flooded land, ...	1	8	0	1	8	0	1	8	0
Dakhur or Rouslee, ...	1	4	0	1	0	0	1	0	6
Bhoor, ...	0	8	0	0	8	0	0	4	0
Culturable waste, ...	0	4	0	0	4	0	0	2	0

114. It will be observed, that I do not rate Canal higher than well irrigation. The difference of expense, might be considered *á priori* to require this; but if the produce of the two be examined, it will be found, that a very considerable portion of Canal irrigated fields, bear indifferent crops, while those watered from wells, are uniformly like garden cultivation.

115. CANAL IRRIGATION.—The indisputable advantage of the Canal, is, the *extent* of irrigated surface; which is so much greater than could be ever practised from wells. But after minute examination, I have come to the conclusion that calculating per standard of measurement (acre or beegah), including expense of raising water on the one side, and water rents on the other, the well irrigation, is fully as remunerative as the Canal, if not more so; and in this opinion I am confirmed, by finding that both in this, and the adjoining pergunnahs of Paneeput, there are many Canal villages, in which the people still continue to irrigate part of their lands from wells.

116. ITS EFFECTS.—It will here be well to advert, to a peculiar characteristic of Canal irrigation, as affecting very materially

the produce. I allude to the efflorescence of soda, impure sub-carbonate of soda, commonly called natron, which covers the soil, in many places making it totally unproductive, after some years of this irrigation.

117. This salt, no doubt, exists in the Canal water; for Jumna water is known to contain such: but it is not the small quantity, which may be deposited in the process of irrigation, which can materially impair the fertility of the soil. The whole of the sub-stratum at a certain depth, contains this salt, and it is, I believe, only when the whole soil, both upper and lower, has been kept continually saturated with water, that natron is found at the surface, in a sufficient quantity to check vegetation. This is most remarkable in Khadir, where the sub-soil, being always sandy, and the surface mould comparatively of small depth, water more readily percolates, but in the Bangur also I have remarked, that under similar circumstances, similar effects are produced, in a modified degree.

118. It is a known fact, that most wells in the vicinity of the Jumna are highly impregnated with natron, many more so, than the Jumna itself; yet with the exception of some peculiar localities, where the water is actually brackish, well-irrigation is never found to impair the fertility of the soil, though the same fields are used for the purpose, from year to year, without intermission.

It may therefore be deduced, that, unless water be much more brackish* than is the Jumna stream, the small quantity used in irrigation, does not contain sufficient salt, to be deleterious.

119. Again, I have observed where large extents of water accumulate, towards the end of abundant rains, that if the soil be strong stiff clay, of sufficient tenacity and depth to prevent percolation, and admixture with the substrata, there will be found little efflorescence, when the water subsides; but on the contrary, if the soil be sandy and easily penetrated, it is very great. This would lead us to believe, that it is, in a great measure, elaborated from the sub-soil.

120. EXPLANATION.—The process may be explained thus: When the alluvion was originally deposited, it probably contained this salt; or it may have been since formed by further decomposition. The upper parts of the soil have been freed from it, by rain. When, however, the sub-soil is saturated with water, by percolation, this salt is dissolved, and the impregnated water, being drawn to the surface by capillary attraction, is constantly there evaporated, leaving its salt behind.

121. I have no doubt, that in the present advanced age of agricultural science, some cheap method of manuring might be de-

* In many pergunnahs of the Goorgaon district, the quality of the water, very materially affects the quantity of the produce, and a certain proportion of contained salt, is even considered beneficial.

vised, which, by neutralizing the natron, would convert it into a fertilizing substance, and as the tract of the country, more or less affected from this cause, is already of considerable extent, and is likely to increase with the extension of Canal irrigation, the subject is, I should think, well worthy of the attention of Government.

122. RATES RESUMED.—To return however to the rates of assessment; those fixed on irrigated, are so much higher, than on unirrigated cultivation, that too great care cannot be taken, in obtaining a correct return of irrigation. Where the measuring Ameens are expert, this is more feasible; but in the present case, for many reasons, I have found it necessary, to adopt more certain data.

123. In Canal irrigation, the amount varies almost every season, under ordinary circumstances; but, where a settlement is known to be pending, the zumeendars, very generally, decrease the extent, in order that they may be rated lower. The same deception is also generally attempted, with regard to well-irrigation.

124. IRRIGATION ESTIMATES.—To guard against this, I have procured from the Canal authorities, a statement of the amount of irrigation, for each of the last ten years, and after striking an average, have added this to the highest amount, during any one year; and dividing by two, have considered the result, as the fair proportion of irrigation, to be computed, for the estate. I intended by this operation,* to give due weight, as well to the ordinary wants of the village, as to its utmost capability, of obtaining water.

125. As a standard of well-cultivation, I have had prepared most accurate lists of all the wells, shewing their present state, whether fit for irrigation purposes or not, and whether carrying one or two laos. Each of the istumrardars was desired to prepare a detailed statement of the wells, in the mouzahs forming his share, and informed, that the data I received, might guide me in the ultimate assessment. My own establishment prepared another list, and a third was extracted from the Ameen's papers: so that by comparing the three, and directing further examination, where material discrepancies existed, I was sure to attain correct results.

126. I have considered each lao, as capable of irrigating $12\frac{1}{2}$ acres. It might be objected, that I have previously stated $12\frac{1}{2}$ as rehut irrigation, and 15 for lao churrus irrigation, but as from the computation which I have there detailed, it would appear, that the extra quantity of irrigated surface, is fully, if not more than counterbalanced, by the extra expense incurred; it would certainly not be fair, to lay a heavier tax on the churrus, than on the rehut.

* This method, though applicable to the pergunnah Kurnaul, situated towards the head of the Canal, and consequently, always enjoying a plentiful supply of water, from that source, would not answer lower down.

The estimated capability for irrigation, mentioned occasionally in Statement III, has reference to the standards of irrigation, thus obtained, in contradiction to the returns of the measuring Ameens.

127. FLOODED LANDS.—The next class of soil is dehur, or lands flooded during the rains. These are of course much more valuable, than ordinary baranee land, and are rated higher. They are either cultivated in rice, during the khurreef or bear fine gram crops for the spring harvest; occasionally both.

128. OTHER LANDS.—Dakhur and Rouslee bear the same rate, higher in the Khadir, because there they produce good grain, and safflower during the rubbee, while the same description of soil in the Bangur, is cultivated with joar for the khurreef harvest. Bhoor is inferior sandy soil, of which there is a very small proportion, in this pergunnah.

129. CULTURABLE WASTE.—This I have rated higher, in the Canal and Khadir villages, and lower in the Bangur, for obvious reasons.

That the results deduced from these rates, coincide very nearly with those arrived at by other officers, my predecessors in this district, may be considered in some degree an assurance, of the correctness of their application. I would therefore draw attention to three mouzahs; Deengurh muzra, Phoosgurh and qusbeh Kurnaul. The half of the former, was settled by Mr. Edmonstone, at 409; my jumabundee or revenue rates, on a slightly increased cultivation, gives 421 rupees. Phoosgurh was assessed by Mr. J. Lawrence, at 2,031-14; my revenue rates being 2,077-8 rupees: and qusbeh Kurnaul was also assessed, in a sort of summary manner, but after detailed measurement, by Mr. Lawrence at 15,900-13; the result of my rates corrected for irrigation estimate, being 14,986 rupees: the difference is but a trifling per centage (6 per cent.)

130. LUMBURDARS OR MOCUDDUMS.—I have had much less trouble, in selecting and appointing the lumburdars in this pergunnah, than I have experienced in the settlement, of any other part of the Delhie territory; partly because the former arrangements had been less interfered with by preceding Collectors, and partly because I was able to refer the litigants, to the istumrardars, whose previous acquaintance with the village details rendered them able to decide, while it was for their own interest, that they should decide rightly, and that fit and proper men should be selected for this responsible trust. I have attended to their wishes on this point wherever they were expressed in time, and did not involve manifest injustice, or militate against the general rules, issued by the Board on this head.

131. GRASS PRESERVES.—In order to carry into execution, the orders of the Lieutenant Governor, for making over to the istumrardars, any excess of forest lands, I obtained from them a list of the mouzahs in which they wished allotments, with details of their

position, and rough estimate of extent. I then referred to the survey maps, and ascertained, (from them,) how those wishes might be carried out, without interfering with the cultivation, or general comfort of the village.

132. I then calculated, on the professional map, the amount of land as appeared most suitable, and comparing the shujrah map, with that of the survey, marked the bounds of the preserve on the shujrah, and laid down written directions, shewing the tehseeldar how to proceed, from point to point in its demarcation; choosing marks not easily mistaken, such as sites of khairuhs, jheels, and projecting corners of cultivation.

133. DURKHASTS.—When I had determined on the proposed juma, for each mouzah, the zumeendars were assembled to give in their durkhasts; but on these being declared to them, the whole of the Bangur villages demurred, alleging that the assessment was much too high, and that they expected something similar, to Captain Abbot's demands, in Kythul; even villages close to Cantonments, which were assessed most lightly, (in consequence of the difficulty they were considered to experience, in keeping up their cultivation, since the breaking up of the Cantonments,) joined in the cry, which I found out had been previously determined on, by a general punchayet of the Nurduk.

134. The people were secretly encouraged, in adhering to this refusal, by Ahmed Ali Khan, the chief istumrardar, who has been very averse to the settlement. He thought thereby to embarrass the proceedings, and postpone the measure, if not avert it altogether, and I was extremely afraid, that the misguided folly of the people, would lead to the introduction of farmers to a very considerable extent; and under this impression, addressed you (No. 212, dated 9th June 1847,) recommending, rather that the pergunnah should be held kham, than that this should be allowed.

135. FARMERS.—I am happy, however, to state, that no such bad effects have ensued; after the prescribed forms had been gone through, and more than the prescribed period had elapsed, I accepted farming tenders for two villages, Dubuh and Poondruk.

136. As soon as it was known, that the farmers had got the lease, the zumeendars wished it annulled, and professed themselves willing to take up the terms; this, however, I was not at liberty to allow, even had it been advisable, and gradually all the other parties have given in their durkhasts. The only other farm, is that of Nisf Deengur mŭzra, which has been leased to the istumrardar under orders of Government, dated 19th May 1847.

137. VILLAGE ADMINISTRATION.—I have previously mentioned, that there is not one regularly divided biswah, in this pergunnah. There being no division of the uncultivated lands, the Government demand is distributed among the proprietors, in proportion to their cultivated holdings.

The baach is thrown in one equal rate, on all kinds of land, whether irrigated, or unirrigated, in every mouzah, except the towns of Kurnaul and Peenglee; where two rates, as per margin,* have been agreed to.

	Irrigated.			*Unirrigated.*		
* Peenglee,.....	1	8	0	0	9	5
Kusbah Kurnaul,	2	5	6	1	8	0

138. It appears strange, that where the assessment is based, on rates which differ so materially, there should exist no difference, in the real distribution of the revenue, over the several varieties of the soil; and more particularly between the irrigated and unirrigated, the discrepancy is, however, easily accounted for thus:—

In the Khadir, the wells being cutcha, requiring little outlay, and lasting only for one season, may be dug by any person who chooses to irrigate his lands; while in the Bangur, the expense of sinking a well, is so great, that it is never undertaken by a single individual, but shared in by the whole pannah, or "tola;" consequently, as each sharer, has a proportionate right of irrigation, his share of the Government demand would not be altered by the adoption of varying rates.

139. In Peenglee, however, this is not the case; the wells belong in common to the Jats, and Brahmins, while the istumrardar, holds as khood-khast, a considerable quantity of baranee lands. In the qusbeh again, Bunyahs, gardeners, and other classes, have become possessed of lands, irrigated from wells, while the zumeendars hold all the outer, and unirrigated portions; a single rate in either of these mouzahs, would consequently fall very unequally, on the different classes of proprietors.

140. The total amount of this baach, includes the Government demand, with moquddumee and road fund; and excludes police charges, and putwarree's salary. The former of these is to be paid by a house tax, and the latter with a muhla, which, whenever required to be collected from the village, will be paid separately, in the same proportions as the Government demand. But it will, I apprehend, in practice, be actually deducted from the jungle dues; which are not supposed to be taken into account towards the satisfaction of the Government demand, but are to be divided among the proprietors, in the same proportion as they contribute to the baach.

141. JUNGLE DUES.—These dues consist of grazing charges, principally levied from inhabitants of other villages, at the following rates:

Female Buffaloe.	*Cows.*	*Buffaloe or common Calf.*	*Sheep and Goats.*
From 2 to 1 rupee.	From 1 to 8 annas.	From 8 to 4 annas.	From 2 to 1 anna.

In some few villages, the proprietors pay a small grazing tax, to meet deficiencies in the cultivation rate. Besides this, non-residents cutting wood and grass, within lands, are taxed from 1 rupee to 8 annas each hatchet, or koolarce; and from one rupee to eight annas, for each spade and sickle, ("koorpa, durantee," meaning thereby, that the sickle may be used during the rains, and the spade during dry season,) for one year, for the payment of 1 rupee.

142. They form, in many cases, no inconsiderable item in the village profits. For instance in mouzah Poondruck, which is close to Kurnaul, the zumeendars refused the terms offered them, and the estate was given in farm :—it is well known that during the last rains the farmer has realized about sufficient to clear the khurreef kists, or 10 annas in the rupee, from the grazing dues above. This has arisen from recent orders of Government, directing a large portion of the Kurnaul parade ground, to be reserved for the purposes of the Remount Depôt, and the town cattle have consequently been taken to Poondruck to graze.

143. KUMENEE.—This tax already often described, is also levied in almost every mouzah from uncultivating non-proprietary residents, and varies from 1 to 2 rupees per annum.

144. POLICE.—I have found little to alter in the chowkeedaree establishment, which has been formed, as far as practicable, in uniformity with the rest of the district, as described by Mr. Edmonstone, paragraph 44 of his Settlement Report.

145. MODE OF ENTRY IN SETTLEMENT STATEMENTS.—I have in this, as far as practicable, adhered to the direction issued by His Honor the Lieutenant Governor. I trust, however, that if I have erred in a slight deviation, the fault may be overlooked.

146. Para. 53 of the Settlement Directions, points out that the cultivated and culturable area, should be taken from the khusreh, and the difference entered as unculturable waste.

147. I found it in cases impracticable, to do this, because the culturable area given by the Ameen, exceeded the total given by the surveyor; I therefore, in all cases, have taken the unculturable waste, and the total area from the surveyor's entries, and the cultivated from the khusreh. The difference I have considered, to be the culturable waste.

148. With due deference to the authority under which the directions have been issued, I venture to submit, whether this would not be a better general practice, as the same difficulty which has occurred here is likely to be met elsewhere. The surveyor's total area, is that which is most carefully and scientifically ascertained; the surveyor's minhaee, is computed in one uniform manner, for the whole pergunnah: if therefore to the latter, are added the lakhiraj lands, they appear to form a trustworthy basis. Whereas, on the other hand, the mode of estimating the minhaees of the Ameens, must in each village, depend much on the bias or know-

ledge of the measure ; and the native measurement of the uncultur-able waste is at best but an approximation to the truth. The grass preserves have been considered as nimhnee, and entered under the head of forest jungle.

149. KISTS.—The instalments for payment of the Govern-ment dues, have been fixed for the same dates, as those in the rest of the district, which appear to require no modification :—the khurreef kists, on the 15th November and 15th December, respec-tively ; and the rubbee on the 15th May and 15th June. The proportion paid in the two seasons, are in the Bangur 10 and 6 annas ; on the Canal, and in the Khadir, 6 and 10 annas : while some intermediate villages pay in equal parts.

PART 3RD.

150. ADJUST-MENT OF CLAIM.—I have now to detail, the steps which I have taken, to carry out the measures contemplated by the Honorable the Lieu-tenant Governor, in the 20th paragraph* of the minute.

* *His Honor remarks :*

"20th. There may be rights to adjust, between the different members of the Nuwab's family. This is a most important, and necessary point to deter-mine. If they can agree upon it there can be no better time for fixing, and recording the family custom, which shall decide existing, and rule fu-ture claims. If there are no disputes at present, that is the very reason why the present time, should be chosen to prevent future disputes."

151. It has been the bane of many families, which through the liberality of the British Government, retained landed revenues in these provinces, that partly in order to meet the exigencies of the disturbed times, immediately preceding our rule, and partly by fraud and violence, many deviations from the usual customs, and laws of inheritance have taken place. Hence in the system of poly-gamy which prevails, both among Hindoos and Mussulmans, disputes and dissensions have arisen, which having been decided differently, by different authorities, Judicial and Political, have generally ended in the total or temporary ruin, of all the disputants.

152. It must be admitted, that it is advantageous, to have a class of wealthy men, resident on the estates, whence their income is derived, interested in the extension, and improvement of agricul-ture, and dependant on the stability of our rule, for the continuance of the possessions to themselves, and their descendants ; and it therefore follows, that it is a matter of the utmost importance, to prevent, as far as lies in the power of Government, this useless and unprofitable litigation.

153. Fully impressed with the force of His Honor's remarks, and with the importance of this part of his instructions, I have spared no trouble, nor pains, to accomplish this object.

154. DUSTOOR-OOL-UMUL.—Ever since I commenced, on the preliminaries of settlement, I have urged the different Mundul chiefs, to consider and prepare a tukseemnamah, and dustoor-ool-umul, so as to be ready by the time the other proceedings should be completed. The invariable answer, which I received from each, was that "the tukseemnamah, was already complete, having been decided in the time of Mr. Seton, Resident of Delhie; but that the dustoor-ool-umul, would be very difficult; yet that if I much required it, and could manage to induce *the other parties* to consult with them, it might no doubt be prepared."

155. Since my return from the Hills, in November 1846, I have been more urgent in my solicitations; but finding that unless, I took more decided steps nothing would be done by the parties in concert, I induced them to meet at my house, in order to ascertain what they would all agree to, and which were the points on which they disagreed.

156. FIRST CONSULTATION.—The first meeting took place on the 7th May; all the chiefs being present, as per margin:* and during the consultation which ensued, and in which all the elders took part, I ascertained, that on the death of Ishak Khan, his sons disagreed as to the division of the inheritance; that Gholam Shurreef Khan, was appointed arbitrator, and adjudged the estate to be divided into four equal shares; one to each brother, setting aside one village, mouzah Pilwát, (now assessed at Rs. 463,) for the eldest, to defray his extra expenses, as the head of the house, and that his decision remained in force, during the life time of the four brothers, all of whom are now dead.

* 1 Ahmed Ali Khan, and Rehmut Ali, his eldest son.
2 Gholam Shurreef Khan, and Kootoboodeen, his eldest son.
3 { Mohomud Ali Khan. / Rehman Ali Khan. / Shumshair Ali Khan.

157. ISHAK KHAN'S DESCENDANTS.—The eldest left a son, Mohomed Ali Khan, who now manages the whole of this property; the second, a son, Rehum Ali Khan, who shares with his cousin; the third left a daughter, and the fourth a son, both minors.

158. It appears, that no steps have been taken, to contract a marriage for this girl, who is, I am told, about 8 years of age, and lives in Mohomed Ali Khan's mehal. The Nuwab Ahmed Ali Khan asserted her to have a just right to her father's inheritance. This was, however, stoutly denied by her cousin, the head of the house, who contended, that he had a right to the whole third share, and would allow his cousin, male or female, as much as he chose, and no more. Gholam Shurreef agreed with him, that women have no portion in the istumrardaree, but silenced him as regard his other assertions, which would have included also the son of the

fourth brother, Shumshair Ali Khan, now a lad of 10, who was sitting in his place, but too young to take part in the conference.

159. The chiefs on all sides, had now become somewhat excited, and I could with difficulty keep them within the bounds of that decorum, which was essential to calm discussion. I therefore gladly acceded to their united request, that further points should be entered upon, at a subsequent meeting, which was fixed for the 21st May. They agreed to have every thing settled among themselves, by that date.

160. When this time approached the Nuwab Ahmed Ali came in the name of all, to request a few day's further delay, and first the 22nd, and then the 24th were fixed; on the latter date, however, all the vakeels came to say, that the Nuwabs had had a long conference which had ended in their sending mounted messengers to Samana, in order to get the opinions of other elders of their house. They promised faithfully, to have every thing ready by the first of June. This delay was therefore acquiesced in.

161. On the morning of the 1st June, I was informed that Mohomed Ali, and Rehum Ali had gone during the night, to complain to you at Delhie.

The Nuwab Ahmed Ali Khan, was either ill, or pretended to be so, and being myself indisposed, no conference took place till the 13th.

162. SECOND CONSULTATION.—Mohomed Ali and Rehum Ali, being still at Delhie, were not present.

The two chiefs, Ahmed Ali, and Gholam Shurreef, stated, that they desired, that the possessor of the istumrar, should have full power to name his successor, and to apportion it as he chose, among his lawful sons, whether by his real wife, his equal in birth or by any woman, he might afterwards take to wife. That this was all they could agree upon.

163. To this I replied, "that I was sorry that they had not come to some decision, to which Government could assent; that instead of endeavouring to prevent future discord, by just and wise resolutions, they had only, as far as I could discover, added fresh matter of discord, to the unhappy differences which already existed; that I could hold out to them, no hope that Government would sanction their proposition: and that, as I found it was useless to attempt to induce them, to comply with the wishes of His Honor the Lieutenant Governor, the meeting need not be prolonged, and that I should press the matter no further."

164. The result of the long and frequent conversations I have had, with all the members of the family, as well separately, as assembled for the purpose of deliberation, has been the conviction that there is little chance of their being, by any means, brought to frame for themselves, any reasonable and general rule of inheritance.

PRESENT STATE OF THE FAMILY.—Although no overt disputes exist at the present moment, between the three heads of the families, yet there is a total want of concord among them; and they are so full of their petty dissensions, and jealousies, and of their own individual interests as opposed to one another, that they are quite unable to enter into His Honor's proposition, of agreeing on a rule of rights for the general good.

I will, in concluding this subject, point out the different subjects, on which the family are likely soon to openly disagree.

165. DISPUTED QUESTIONS. FEMALE INHERITANCE.—The first is the inheritance of females. There has only, once before, within the memory of the elders, occurred a case where a sharer left an only daughter; and on this occasion, the question was put an end to, by the marriage of Gholam Shurreef, to the heiress his cousin. In the case which is now at issue, Sooltan Deen Khan, third son of Mohomed Ishak Khan, died suddenly, and within a very short time afterwards, his wife died also, giving birth to a child, which did not survive.

They left an orphan daughter who with all her father's and mother's effects, came under the possession and guardianship of her cousin, Mohomed Ali Khan, who I have been told, both by Nuwab Mohomed Ali Khan, and Gholam Shurreef Khan, destroyed a will to which they were witnesses leaving every thing to this daughter.

166. It is very certain, that the family custom, has not been to give to female descendants, a portion of the landed property; when there were brothers. The question is, where there are no brothers, what is to be done? and in the present instance, is this girl to be allowed to be devoted to a single life, in order to swell the coffers of the head of the house?

167. I would remark, that the former possessions of this Mundul family, were held in jaidad under military tenure, viz. of furnishing a certain number of horse, headed by the chief himself, and it is self-evident, that Moosulman females, could not under such tenure, inherit. *Now* however the tenure is altogether altered: It is an istumrar, with no feudal stipulation, and there seems therefore, no valid reason, why this incapacity should continue.

168. PARTITION.—The second point is that of partition of inheritance, or succession in the male heir. The case which will first come to issue, is that of Shamshair Ali Khan, already mentioned. He will, of course, on coming of age, wish to take possession of his father's share, which his cousin now manages, and maintains to be his own.

169. There can exist no manner of doubt, as to the family custom on this head, for we find in the first tukseemnamah, Mohumdee Khan, Ghyrut Ali Khan, and Ishak Khan, sharing equally the one having an extra allowance, expressly for the purpose of keeping up the chieftains' ordinary expenses.

The exactly similar apportionment, among the four sons of Ishak Khan, I have already mentioned, and it is only since their death, that the son of the elder brother having become guardian to the whole estate, is endeavouring to appropriate it to himself. He has, (I am given to understand,) reconciled one of his cousins, Rehum Ali, to this arrangement, by promising that he shall share in the plunder, of the other two.

170. These families stand in a somewhat anomalus position. They were, as located in the Doab, independant of the Civil Courts. Here however they are subject to them, and consequently the Mohomedan law of inheritance would be enforced, were they to sue each other in a Court of law, while others, such as the Jagheer, the Buhadurgah, the Patondee chiefs, &c., do not follow the laws of subdivision, but the eldest son succeeds.

171. PROBABLE RESULT.—It would be, in my opinion, a wise and politic measure, if Government were to declare, some general rule; so as to prevent the family, degenerating into a nest of idle, and consequently vicious paupers.

This object might be secured, by allotting a certain portion of the proceeds of the estate, to the eldest legitimate son, as the head of the family, and dividing the rest among the various collateral branches, in fixed and determinate proportions, varying in amount, according to the degree of relationship.

172. That the chiefs will unanimously agree, to any arrangement of this kind, is not to be expected.

MOHUMDEE KHAN'S DESCENDANTS.—Ahmed Ali Khan, the Nuwab, has children by three mothers, his eldest son, a young man about 25, Rehmut Ali Khan, is by his first wife, a woman of Rangurh caste, since dead, the second is by a dancing girl, with whom the Nuwab had contracted marriage, and to whom he was exceedingly attached; he consequently wishes to make this boy, the head of the house. The third son, is by a wife of equal degree with himself.

173. GHEYRUT ALEE'S DESCENDANTS.—Gholam Shurreef has children in the same manner by three or four wives. There exists however no feud or difference in this division of the Mundul family.

174. In the third division alone, are there actual disputes; not immediately brought to legal issue, on account of the minority of two out of four of the parties, but not the less existing, as I have explained in paragraphs 165—169.

175. TEHSEELDAR'S SERVICES.—I feel it my duty to bring most particularly to your notice the invaluable assistance that I have received, from Kedarnath, the tehseeldar of Paneeput Bangur, who has during this settlement, performed the duties which usually devolve on a Deputy Collector; Mr. Johnson, having been fully engaged in the current business of the district.

176. Kedarnath, I believe, was employed under Mr. Edmonstone, who settled the Soneput and Paneeput pergunnahs of this district, and in that manner, acquired the knowledge which I have found so useful to me, during my present operations. He is conversant with English, and possesses testimonials from every officer, under whom he has served. I do not think, that there is a native officer more deserving of promotion, within the Upper Provinces.

177. CONCLUSION.—In concluding this already lengthened report, I beg leave to hope that the Government will not view, with too great harshness, the period of time which has elapsed, since I have been in charge of this settlement, trusting that I have already satisfactorily explained the causes of the delay.

178. The assessment of the Government demands, for a term of years, which I was given to understand would not be less than 30, is a measure of such importance, that the delay of a few months, or even of a year, appeared to me to weigh lighter in comparison with the thorough investigation and correct application of the details, which form the ground work; and I conceive I should have been wanting to the true interests of Government, and to my own duty as its servant, had I allowed any consideration of haste, to interfere with the careful discharge of this undertaking.

179. I have not aimed at pleasing all parties, for I know that where conflicting interests of such magnitude, are at stake, it were impossible. I believe, however, it will be found that the people have no difficulty in paying the assessment, and that the whole has been fairly distributed; also that the chief object of Government, viz., the reclamation of the people from their present lawless state, by giving them good inducement to apply themselves to agriculture, will in course of time be attained, without unduly sacrificing the revenues of the individual family. As some support to this opinion, I may mention, that already in many of the large villages, a considerable portion of the waste, has been broken up.

180. I have been engaged, almost uninterruptedly, in settlement work, from the beginning of the year 1835 to 1840, and now again since my return from furlough, in April 1845, to the present date; and I trust, that Government will find in the result of my present labours, that I have neither spared myself trouble, nor been wanting in experience.

I have the honor to be, &c.,

C. GUBBINS,

Collector.

ZILLAH PANEEPUT:
Collector's Office, Camp,
Nov. 30th, 1847.

No. XXXII.

MEMORANDUM REGARDING WEIGHTS AND MEASURES IN THE DISTRICT OF CAWNPORE;

BY

R. MONTGOMERY, ESQ.,

Collector and Magistrate of Cawnpore.

Regulation VII. of 1833 had in view amongst other objects that of fixing, "the weight of the Furruckabad Rupee as the unit "of a general system of weights for Government transactions "throughout India under the native and well-known denomination "of the Tola."* Since then it has been the weight used in Government transactions. It was apparently not the intention of the Legislature to fix this as a standard weight for all mercantile transactions. It was left to traders and others, to fix their own standard, according as habit or interest led them to prefer. It is well known that the greatest irregularity prevails throughout the North Western Provinces with regard to weights, and not only do they vary in districts, but in villages in the same district. There can be no doubt that this is a hindrance to business, and that it tends to create confusion and affords opportunity for fraudulent transactions. Some serious cases of fraud, were brought to my notice shortly after joining this district, owing to the diversity of weights. I was aware

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* PREAMBLE REGULATION VII. OF 1833.

Latter part of Section IV.

"The Tola or Sicca Weight to be equal to 180 grains Troy, and the other denominations of Weight to be derived from this unit, according to the following scale:

8 Ruttees = 1 Masha = 15 grains Troy.
12 Mashas = 1 Tola = 180 ditto.
80 Tolas (or Sicca Weight) 1 Seer = 2⅔ lbs. Troy.
40 Seers = 1 Mun, or Bazar Maund = 100 lbs. Troy."

that I could not introduce any general standard of weights contrary to the wishes of the people, and I therefore summoned the heads of the different trades in the city, to a conference, and suggested to them the propriety of their fixing a standard weight for all their transactions. I intimated that the Government weight of 80 tolas would perhaps be the most convenient. After much discussion they agreed to assimilate all their weights to that of the Government standard of 80 tolas; but they urged the necessity of having a similar standard in the Cantonments, without which the adoption of any change would be useless.

This appeared reasonable, and I entered into a correspondence with Major Nuthall the Commissariat Officer, and Captain Harris the Cantonment Joint Magistrate, on the subject. They both agreed with me, as to the propriety of introducing uniform weights; and the former Officer pointed out,* that the 80 tola weight was the only one allowed to be used in Cantonments.

After allowing a certain period to elapse for the purpose of preparing weights, a day was fixed for the adoption of the new weights both in the City and Cantonments. Several thousand weights were made up in the Cawnpore Magazine, with the aid of Captain Reid; and a great many were manufactured in the City.

After the lapse of a few months, I found that the Bunniahs and others dealing directly with the City, were desirous of having their weights assimilated to those in use there. This seemed to be a favorable time to make the measure a general one. I therefore directed the Tehseeldars, to ascertain the feelings of the people on the subject, and to explain to them the advantages of having a general standard weight. They did this most judiciously; and reported that the people were prepared to adopt the seer in use at Cawnpore. I then sent the form *Appendix A*, to be filled up by the different Tehseeldars; directing them to make the individual, who required the weights, sign his name in the column left for that purpose. On the returns having all been received, I found that the Tehseeldar's statements were correct, and that the people were unanimous on the subject.

It became of great importance to secure the breaking up of the old weights, as, were they allowed to exist, confusion would be the result. The Tehseeldars, with the consent of the people, set up forges at the Tehseeldarees, and received the old iron weights at a

* "The new system of weights prescribed by Regulation VII. of "1833, in the Financial Department having been ordered to be observed in all "Commissariat transactions, the Governor General of India in Council, with "the view of introducing an uniformity of system, is pleased to direct, that "the new standard of 80 tolas shall be adopted in all Military Bazars and "Cantonments, from and after the 1st November next."—*G. O. G. G., No. 184, dated 17th August* 1835.

certain valuation, which was deducted from the price of the new ones. In a few months 40,206 weights were issued. In some cases the people preferred making their own weights, but they were stamped and verified by the Tehseeldars. When a pergunnah was completed, the return in *Appendix B* was required.

The 80 tola weight now generally prevails throughout the district. In certain localities, especially on the borders of other districts from whence the markets are supplied, different weights will sometimes be found; and this must be expected, till such time as the Government weight becomes universal.

At the same time the cloth merchants in the City all agreed to adopt one uniform measure; and the English yard was fixed upon. No other is now in use. Several hundred yard-measures were made up, tipped with brass, and stamped. They were sold at 2 annas a piece, and were in great demand. It became necessary to make several sets; and, after being verified, they were sent to the Kotwallee for sale.

As soon as the new standard weights and measures were universally adopted in the City, they began to be used throughout the district. This will always be found to be the case. In such places as Cawnpore, Meerut, Agra and Delhi, the Sudder Bazars, situated in Cantonments, invariably regulate all the rest; and if the Government order on this point be only strictly carried out in the former, it will without difficulty be followed in the latter.

The Tehseeldars are a most valuable agency, through whom any general measure of this kind may be successfully introduced.

Annexed is a list *(Appendix C)* of the weights made up and distributed, with their average cost. The prices vary in the several pergunnahs. One reason for this, is, that in some localities (near the Jumna for instance) iron is cheaper. Another reason is, that some of the Tehseeldars have managed the matter more economically than others. In no place has the price been excessive.

R. MONTGOMERY,
Collector and Magistrate of Cawnpore.

APPENDIX A.

FORM.

Name of Village.	Name of Shopman.	*No. of Weights required.*							*No. of old Weights which will be given up.*							Signature of the Individual requiring them.
		Punseree.	Seer.	½ Seer.	¼ Seer.	⅛ Seer.	Chittack.	Total.	Punseree.	Seer.	½ Seer.	¼ Seer.	⅛ Seer.	Chittack.	Total.	
Malon,	{ Hoolas Bukal. }	0	1	1	1	1	1	5	Has none—borrows from his Partner.							Hoolas Bukal.

APPENDIX B.

FORM.

Name of Village.	Name of Shopman.	*Number of Weights made up and distributed.*							*Price of the new Weights.*						Value of old Weights.	Remaining balance due.	Date of distribution.	By whom distributed.	Signature of the person who received the weights.	Signature of the person who received the price.
		Punseree.	Seer.	½ Seer.	¼ Seer.	⅛ Seer.	Chittack.	Total.	Punseree.	Seer.	½ Seer.	¼ Seer.	⅛ Seer.	Chittack.	Total.						
									As. P.	As. P.	As. P.	Pie.	Pie.		As. P.						
Malon,	{ Hoolas Bukal. }	0	1	1	1	1	1	5	0	7 1½	3 7	1 9½	11	5½	13 11	0	As. P. 13 11	9th April 1848.	Mahomed Khan, Jemadar, and Muttra Pershaud, Mohurrir.	Hoolas Bukal.	Muttra Pershaud.

APPENDIX C.

Name of Pergunnahs.	Number of Shops.	Number of Weights distributed.	Average number taken by each Shop-keeper.	Average cost of Weights in each Pergunnah.																							
				Punseeree.			Seers.			½ Seers.			¼ Seers.			⅛ Seers.			1 Chuttack.			Total.		
				Rs.	A.	P.	R.	A.	P.	R.	A.	P.	R.	A.	P.	R.	A.	P.	R.	A.	P.	R.	A.	P.
Bithoor,..	1025	4054	4·0	2	3	10	0	7	1½	0	3	7	0	1	9½	0	0	11	0	0	5½	13	1	9
Derapoor,..	377	1174	3·1	1	9	9	0	5	2	0	2	7½	0	1	3½	0	0	8	0	0	4	2	3	10
Bhogneepoor, ...	692	2821	4·0	1	8	6	0	4	10½	0	2	5½	0	1	2½	0	0	7½	0	0	3½	2	2	0
Secundrah, ...	475	1802	3·7	1	12	5	0	5	9½	0	3	1½	0	1	4	0	0	9½	0	0	6½	2	5	0
Akberpoor, ...	666	2633	3·9	0	*8	0	0	*1	0	0	*1	0	0	*1	0	0	0	*6	0	0	*6	0	*12	0
Jaujmow, ...	699	3360	4·8	†2	3	10	0	7	1½	0	3	7	0	1	9½	0	0	11	0	0	5½	†3	1	9
Belhoor, ...	655	2454	3·8	1	11	5	0	8	6	0	2	9	0	1	4	0	0	8	0	0	4	2	6	0
Russoolabad, ...	470	1896	4·0	2	0	0	0	6	4½	0	3	2½	0	1	7½	0	0	9½	0	0	4½	2	12	4½
Sarh, ...	722	3134	4·3	1	12	1½	0	5	7½	0	2	9½	0	1	4	0	0	8½	0	0	4½	2	5	11½
Ghatumpoor, ...	861	3275	3·8	0	*8	0	0	*1	0	0	*1	0	0	*1	0	0	0	*6	0	0	*6	0	*12	0
Sheorajpoor, ...	387	1521	3·9	1	13	3	0	5	11	0	2	11½	0	1	6	0	0	9	0	0	4½	2	5	9
Kotwalee,..	.....	11082	.....	....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Total number of Weights,....	.....	40205																						

* In Ghatumpoor and Akberpoor the labour alone is entered, and not the value of the iron.

† The City and extensive suburbs are included in these Pergunnahs. The weights were generally made up in the Magazine. They were more expensive but better executed.

R. MONTGOMERY,
Collector and Magistrate of Cawnpore.

No. XXXIII.

ELLIPTICAL TUNNEL BRIDGE AT SEONEE.

Letter No. 3662, *dated Allahabad, 9th March,* 1849, *circulated by* MAJOR A. H. E. BOILEAU, *Superintending Engineer, Central Provinces.*

SIR,

I have the honor of forwarding, for your use, a plan of the ELLIPTICAL BRIDGE, built at my suggestion, by Lieutenant D. Briggs, Executive Officer of the Great Deccan Road, in 1847-48, one mile southward of the station of Seonee; and which, after having been exposed to the action of two monsoons, or rainy seasons, has been found to answer its intended purpose, admirably; viz., to substitute a cheap tunnel, with scarcely any foundations at all, in place of the ordinary kind of bridge, with massive and costly foundations, which have usually been considered necessary in bad sites, and specially on the black cotton soil of Malwa and Gondwarra.

2. The Elliptical Bridge, of which the plan is herewith circulated, has a water-way of 10×6 feet, with a tunnel about 22 feet long and $1\frac{1}{2}$ feet thick, lying upon a thin bed of concrete, (as shown in the drawing,) and without any other foundation, than a front and rear drop-curtain of $2\frac{1}{2} \times 2\frac{1}{2}$ feet section, by which the stratum of black soil, underlying the concrete, is maintained in a compact state; and any cutting away of the bed of the nullah by the current is guarded against: though this had been partially provided for by sinking the floor of the tunnel, nearly a foot below the natural bed of the stream.

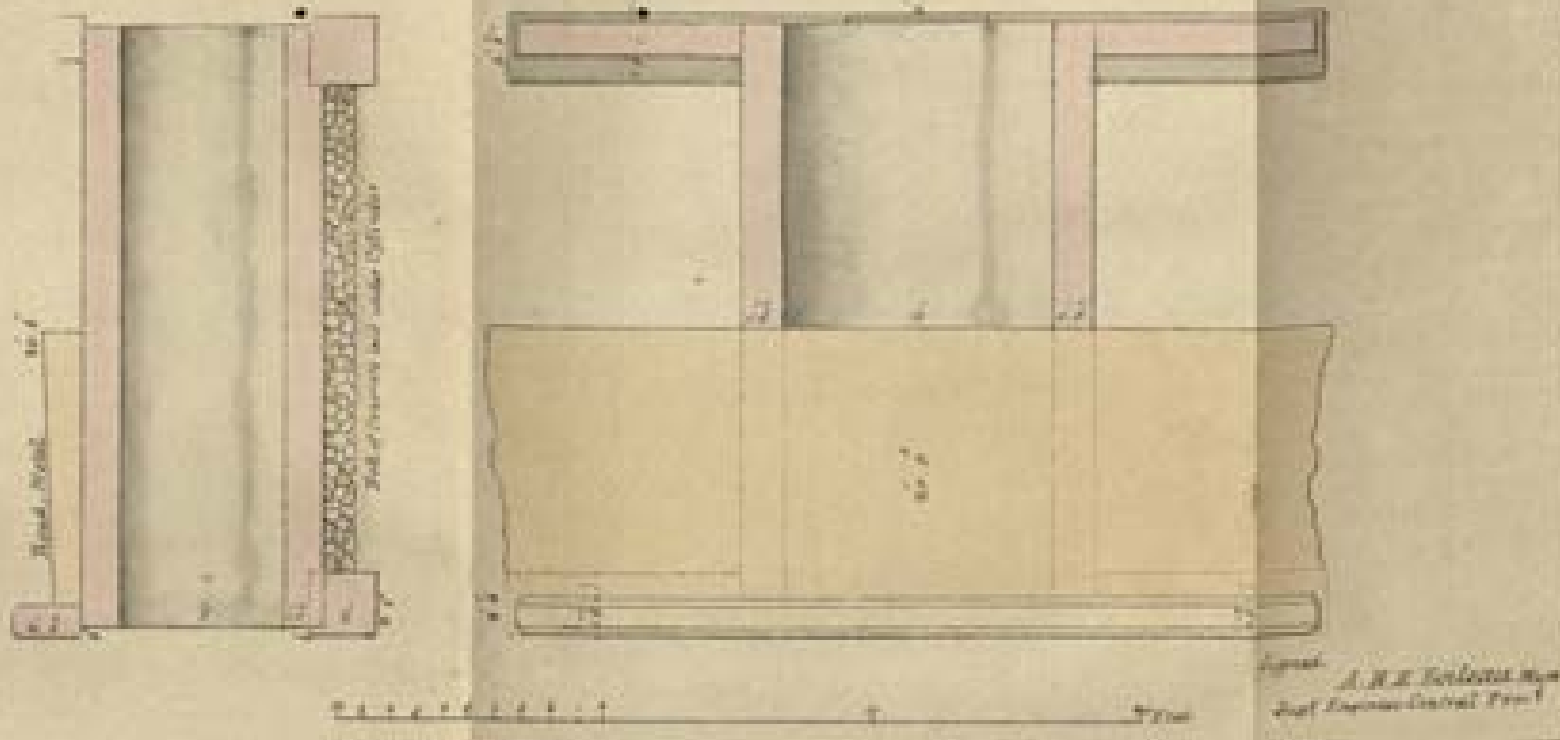
3. The cubic contents of this bridge are 1,258 feet of plain masonry, (burnt bricks set in lime mortar) and 1,030 feet of elliptical masonry of the same kind; the whole being plastered as usual, and costing Company's Rs. 248-10. The kind of bridge, for which it was intended as a substitute, was to have cost 640 rupees; the tunnel being 24 feet long, the parapets 2″ thick, with a road-way of 20 feet; and a water-way of 10×7 feet; so that the difference in point of cost is most strikingly in favor of the elliptical bridge.

I have, &c.,

A. H. E. BOILEAU, MAJOR,

Superintending Engineer, C. P.

PLAN
of an
ELLIPTICAL BRIDGE
Built on the Great Deccan Road
One mile to the south of Sattara.



Signed A. H. E. Forbes Major
Asst Engineer Central Provs

Extract of a Note from CAPTAIN J. R. OLDFIELD, *Executive Engineer, 5th Division, Agra, on* MAJOR A. H. E. BOILEAU'S *Tunnel Bridge for small spans.*

The concrete, I am in the habit of using, consists of,

One part,—Well ground mortar; made with kunkur, lime, and bujree or coarse sand; in the proportion of 1 of the former, to 2 of the latter;—

One part,—Coarse bujree or gravel;—

Two parts,—Well burnt brick, broken up into pieces which would pass through a ring of 1½ inch diameter.

The mortar, gravel, and broken brick, to be intimately mixed in small heaps, so as to preserve their relative proportions throughout the mass. The mortar should be used quickly, as it comes from under the rollers, and never allowed to dry till the work is complete.

The concrete may be laid down in layers of from 6 to 9 inches thick, and beaten with heavy rammers, whilst thoroughly wet, and before being allowed to set. In case of more than one layer being required, the lower one should not be allowed to set before the upper one is added.

The bottom of the excavation may also be well rammed before the concrete is laid down, should the soil be compressible by the blows of an ordinary rammer.

J. R. OLDFIELD, CAPTAIN,
Engineer.

Agra, 5th April, 1819.

No. XXXIV.

REPORT ON THE BHEJ BURRAR TENURES, IN ZILLAH BANDA.—BY THE LATE H. ROSE, ESQRE., COLLECTOR OF BANDA.

To R. LOWTHER, ESQUIRE,

Commissioner of the Allahabad Division.

SIR,

In accordance with the orders recorded by the Lieutenant Governor in a note, dated the 12th April 1845, I have the honor to submit the following report, regarding the BHEJ BURRAR TENURES in the Banda district.

2. Mr. W. B. Wright, (page 22, of his Settlement Report,) says, "The peculiarity of this tenure was, that the owner of a "parcel of land paid his quota of the jumma according to a *baach*, "applicable to the whole estate; which *baach* was liable to alter-"ation, whenever a sufficiently powerful party could be got toge-"ther on the estate."

3. He then goes on to shew the evils of this system, and the advantages to be expected from his proceedings; which, instead of acknowledging the principle of change, in the rate or *baach*, defined the holdings of land and portion of jumma, which each sharer should occupy and pay, without alteration, till the end of his 30 years' lease.

4. Mr. Wright represents these arrangements as having been very acceptable to the people; but, when the new system began to be enforced, numerous petitions were presented, representing, on the part of the whole or a portion of the sharers, their dissatisfaction with the settlement arrangements: and on enquiry

it was found that in several cases, the sharers had themselves resorted to the old system, in the face of the settlement record. The result was, that, a general investigation into the settlement proceedings, as regards the Bhej Burrar villages, was ordered, with the view of revising Mr. Wright's arrangements where they had already been set aside by the people themselves, or where good cause for dissatisfaction was found to exist.

5. Mr. Elliot, in page 60 of his Glossary, has given a very good description of the Bhej Burrar Tenure. "A tenure frequently met with in Bundelcund, in which the sharers of the brotherhood are liable to periodical, or occasional adjustment, and in which balances of revenue and village expenses occasioned by the fraud or insolvency of a sharer, are made good by a rateable contribution from the other sharers. Strangers are often introduced in over assessed estates, on condition of paying the Burrar; but their admission by no means, as is sometimes supposed, forms a necessary incident of the tenure; of which the chief characteristic, is, the re-adjustment of the Burrar. At the late settlement of Bundelcund, it was stipulated in many instances that this liability to readjustment should cease, and practicably, for some time previous, the readjustment had not been demanded, except upon occasions of a new settlement. It is probable that in a short time, as the value of property increases, the Bhej Burrar tenure will altogether cease to exist."

6. The peculiarity of the tenure, then, is that the jumma is liable, under certain circumstances, to a readjustment or fresh distribution, within the term of a settlement, and that the balance of a defaulter is occasionally made good by a rateable contribution from the solvent sharers.

7. It is impossible to trace back this peculiarity of tenure to its origin. It may have been adopted by the people themselves, as the simplest mode of administration; or it may have been forced upon them by high assessment; or it may have originated in the former way, and have been continued by the latter cause.

8. If a colony or a few individuals were suddenly to settle down in an uncultivated tract of land, their first step would naturally be, to spread themselves over the lands, as choice or chance directed them; and the next process would be, to distribute the Government tax, on the fields which each had brought into cultivation. During the earlier years of their location, whilst the uncultivated area was extensive, the changes in the condition of each cultivator would be great. Superior industry, or skill; sickness; the good fortune of hitting on a genial soil, or the reverse; would advance or retard the prosperity of each cultivator; and as the cultivation varied, so, of necessity, would the portion of jumma which each was able to contribute, fluctuate. Here we can easily suppose an annual distribution of the jumma over the cultivation

to be introduced, as the simplest and readiest mode of village administration. It is equally easy to perceive, how, in this state of things, cultivators (separate from the original stock) would afterwards be introduced and allowed to possess the same advantages as the original colonists. Let us suppose three original colonists, holding each 100 cultivated beegahs; the jumma being Rs. 300. It is clear, that if these three can introduce six strangers, and each of these strangers cultivate 50 beegahs from the previously waste land, the original three colonists will thereby be relieved of exactly half their burden. Before the introduction of the strangers, each original holder would pay Rs. 100. After the introduction of the strangers, with the same extent of cultivation each would only pay Rs. 50

9. It is not improbable that the other peculiarity of the tenure, viz., the custom of getting rid of a balance, by a rateable contribution from the solvent sharers, may have had its origin in the extravagantly high assessment of the district, and the mode in which the revenue was realized. The tehseeldars ascribe much of the difficulty which has been experienced in collecting the revenue since the settlement, to what they call the *ekjaee* system of collection being abolished. The ekjaee system, was nothing more or less than this: at the end of the year the tehseeldar with a large party of chuprassees, went the round of the villages in arrears, and after seizing the whole of the sharers proceeded to exact the arrears, from the entire body without distinction or reference to any division of responsibilities. It is not unlikely, that this indiscriminate enforcement of the Government demand, may have often compelled the solvent sharers to relieve their defaulting brethren without an equivalent.

10. The kham tehseel administration of the district, must also have tended to disturb and confuse the land tenures. From 1237 Fuslee to 1241 Fuslee, more than two-thirds of the district remained under kham management. During that period, the proprietary communities were treated as mere cultivators, the fields changed owners, new land was broken up, and old cultivated land became waste; so that when the estates were again restored to the proprietary communities, all vestiges of the former holdings were effaced, or had become so complicated, as to make it impossible to trace them back without innumerable disputes. In such cases, to get rid of all difficulty, the sharers almost invariably adopted the Burrar system; that is, they held the bunjur land in common, and equally distributed the jumma over the cultivated land, as then held, without reference to the changes of occupancy, which might have occurred under the kham management.

11. However the peculiarity of tenure may have had its origin, it appears to me, in tracing its progress, that it has long been regarded by the people themselves, more as a necessary

evil, which they would throw off if they could, than as a custom which they are interested in maintaining. For instance, a new distribution of jumma is seldom made pending the term of settlement when it can be avoided, and, generally, not until long after it is demanded. When it is made, there is no stipulation for its renewal. On the contrary, every distribution is supposed to be the last that will be necessary, and remains in force until certain circumstances compel a new one. The circumstances which compel a new one, are, a balance which cannot otherwise be got rid of; disputes regarding inequalities of rate, which threaten to lead to a balance; a measurement of the land, which shews any great inequality in the existing rates: and a settlement.

12. We will suppose that a distribution of the jumma has been made in a village, over the holdings of cultivation. The sharers make a fresh start, under an arrangement whereby each has to pay a portion of the jumma suited to his circumstances, or, (what is much the same thing) to his cultivation. Matters proceed smoothly at first, and all are pleased, so long as the holdings of cultivation remain nearly as they were, when the last distribution of jumma was made. But, in course of time, and particularly if there be much bunjur land, material changes take place. One man extends his cultivation; another keeps his stationary; whilst a third, perhaps, allows his to become waste: and, as the division of jumma remains unaltered during these changes, the equality of rate on the cultivation which at first existed, soon becomes lost. Discontent then begins to shew itself, and increases with the inequality of rate until at length the less successful sharers form a party, and demand a new distribution of jumma suited to their diminished holdings of cultivation. This demand is at first strenuously resisted by the party who have increased their cultivation, and the contest continues until the appearance of a balance, and the dread of a transfer, force upon all, the necessity of making some arrangements whereby the Government demand will be secured.

13. It by no means follows as a matter of course, that the balance shall be got rid of either by a rate on the solvent sharers, or by a new distribution of jumma. Provided the lands then cultivated by the defaulters, possess sufficient value to procure a transferee amongst the sharers, they are frequently transferred for a time in mortgage, or in perpetuity by sale; just as in ordinary putteedary estates. But when the defaulters' lands are so worthless, that no solvent sharer can be found who will pay the balance and take them off his hands, *then* the whole community unite, and either levy the balance by a rate amongst themselves or make a fresh partition of the jumma. In the first case, the process is a temporary arrangement, for getting rid of a pressing difficulty; in the latter case, the arrangement is permanent, until a similar

necessity compels a new distribution: in both cases, the integrity of the coparcenary mahal is preserved.

14. The mode of distributing the jumma varies. Most generally, the cultivated area of each sharer is ascertained; and one rate is applied to the whole: but sometimes, regard is paid to the soil; and 1 beegah of *Mar*, or rich land, is held equal to 2 or 3 beegahs of the poorer soil. The beegah employed in Burrar cultivation also varies; but generally a measure of land equal to three local beegahs, is the standard adopted. The distribution of jumma is sometimes made by the people themselves, assisted by the putwarry; sometimes by a punchayet: and the extent of land is ascertained by a measurement, or assumed on an estimate, as the people are able or not, to bear the more expensive process.

15. Having attempted to shew what may have been the origin of the Bhej Burrar tenure, and to explain the circumstances under which a new distribution of jumma takes place, and the mode in which it is conducted; I shall now proceed to notice the late Settlement Officer's proceedings, and to explain the causes which, in part, led to their failure.

16. In the note of the Lieutenant Governor, it is explained, that perfect putteedarry, imperfect putteedarry, and zemindarry, are all included in the Bhej Burrar tenure. The fact is, that in this district, every village, which is still in the possession of the old coparcenary communities, is termed Bhej Burrar. In most of these, the liability of the jumma to readjustment, can be traced; but in several, the division of jumma had undergone no change for many years previous to the present settlement. The success which attended the attempt of the Settlement Officer, to abolish the liability to change, was of course in a great measure influenced by the stage to which the tenure had arrived. Where all the land was already divided, and the portions of jumma had not fluctuated for twenty or thirty years, there was little if any change required. Where, on the contrary, the whole land was undivided, and each paid according to his cultivation for the year, a complete revolution was necessary, to attain what the Settlement Officer desired.

17. In perfect putteedarry villages, where the whole of the lands are divided, the liability to variation in the cultivation is much less than on villages where there is an extent of culturable land held in common; and, consequently, the causes which induce a new distribution of jumma are less frequent in the former than in the latter. In few of the perfect putteedarry villages which I have found, had there been any change for several years preceding the settlement; and, in the great majority, the jumma had not been altered since the previous settlement, or since the estate had emerged from kham management, or

had been restored to the old community from the possession of a stranger.

18. But, although no change had taken place, the liability to change was universally admitted, under certain circumstances; and one of these circumstances was invariably allowed to be a measurement, and settlement of the estate.

19. There was therefore nothing anomalous, or contrary to the principle of the tenure, in a distribution of the jumma, in accordance with the holdings at the time of settlement. All that was necessary, was, in the first place, to decide whether the inequality, between the land holdings and existing partition of jumma, was such as to call for a readjustment; secondly, if so, to see that the readjustment was fairly made: and, thirdly, to take care that the alteration made was understood, and acted on.

20. Occasionally, the officers, conducting the detail of the settlement, do not seem to have exercised a sound discretion on the first of these points. The case of Bumkhete, (No. 2 of the *Appendix*) for instance, affords an example of failure, resulting from the former partition of jumma *not* having been altered.

21. Again, there are cases, where the adjustment was made on such irrational grounds as made it impossible that it could be enforced. Take for instance the case of Khujooreea (No. 3, in the *Appendix*) where a punchayet distributed the assessment according to shares, invented by themselves; although the latter and the land holdings by no means corresponded.

22. The upholding and enforcing of the Settlement proceedings was, in a great measure, beyond the control of the Settlement Officer, being dependant upon the exertions of the tehseeldars and their superior. The tehseeldars were, chiefly, men temporarily employed; the best of the old tehseeldars being engaged in the settlement. These temporary officers were utterly ignorant of settlement matters; and, indeed, with some few exceptions little better instructed in revenue duties. Without imputing to them wilful misconduct, they were incapable of doing justice to the settlement; and accordingly, in several cases when the new arrangements were unexceptionable, some interested parties were allowed to set them aside, and to reintroduce the old Burrar, to their own advantage, and to the detriment of the great bulk of the village community.

23. The foregoing remarks, regarding perfect putteedarry tenures, are equally applicable to imperfect putteedarry villages. In the latter, as well as the former, there were several cases in which the division of jumma had undergone no change for many years before the settlement. The only material difference in the settlement proceedings, was, that, in imperfect putteedarry tenures, a partition of the common land was made previous to the new distribution of the assessment; and as this partition was frequently

either not understood, or not acted on, the liability to failure was greater in imperfect putteedarry than in the former class.

24. The success or failure which attended the attempt to divide the common land, was mainly dependant on the existing tenures. Where ancestral shares were previously known, and the common land at the time of settlement was divided in accordance with these, the partition has very generally been adhered to: but where the division of common land was made according to the existing Burrar, or according to the extent of divided land; or, rather, where shares were created on the extent of divided land, or on the existing Burrar, and those newly created shares were made the basis of a division of the common land; the partition has been invariably disregarded, and the people have continued to hold the previously undivided land in common, as before, either adhering to the old Burrar, or making a new distribution, as was most convenient.

25. The zemindarry tenure in no way differs from the usual custom, where the zemindars cultivate at seer rates, throw the whole into a common stock, and divide the profits according to ancestral shares. The Settlement Officer, in dealing with these tenures, usually divided the land and jumma according to ancestral shares, and I have not met with a single instance in which his arrangements in that respect, has not been carried out and acted on.

26. In the perfect and imperfect putteedarry tenures, which I have just noticed, the liability of the jumma to distribution, is occasional, and dependant on contingencies. But, there is a class of Bhej Burrar villages, in which it is the custom to make an *annual distribution* of the jumma over the cultivated area. This distribution is made twice in the year; once, at the end of the Khurreef sowing; and again at the end of the Rubbee sowing; by the application of an equal rate to the cultivation. The extent of cultivation of each sharer is sometimes ascertained by a measurement, but is often determined by an estimate (*tukhmeenun*). The only fixity of property there is, on villages governed by this tenure, is, that a sharer, having once cultivated a field, retains possession so long as he continues to cultivate it, and pay the rate; but having once ceased to cultivate and pay the rate, his ownership to the field ceases, and it becomes the property, on similar terms, of any sharer who choses to plough and sow it. The getting rid of a balance from an insolvent sharer by a rate on the whole, may be said to be the rule, instead of the exception, in these villages. The lumberdar may, if he chooses pay the balance, and take into his own possession the lands of the defaulter; or he may, if he can, transfer them to a solvent sharer on payment of the arrears; but much more commonly, he pays the balance in the first instance, leaves the land with the defaulter, and at the end of the year

throws the balance into the village expences, and levies it by the rate of the year from the whole community.

27. The attempt to determine the holdings and portions of jumma in these villages, was generally made by taking the cultivation as it stood during the year of measurement, dividing the common land in accordance with the cultivation, and determining the jumma which each puttee, so constituted, should pay. In every instance which I have seen, this attempt has failed, and the people have reverted to the old system of administration.

28. There is one form of the Bhej Burrar tenure in this district, which, as far as I am aware, has not been noticed elsewhere. The tenure is called *Pouth*; and its peculiarity consists in the custom of a certain portion of the lands changing its owner every year, by regular rotation; the payments of the sharers included in that rotation, increasing and decreasing yearly, by the jumma put upon the field, or fields, as they come into, or pass, from their possession.

29. The derivation of the term *Pouth* is not known, nor have I obtained a plausible conjecture as to its origin. The origin of the custom, is thus explained by the people themselves. The villages, in which the tenure exists, are on the banks of the Jumna.* The soils vary much in quality; the higher lands being very poor, whilst the terrai and cutchar lands in the villages, are unusually fertile. When the area of a village came to be divided, it sometimes happened, that the low-lying lands were not sufficiently extensive to admit of every sharer having a portion; whilst, on account of the superior productiveness of such lands, no one was willing to take an equivalent out of the inferior soils. In this difficulty, the sharers divided the coveted land, into as many fields as its area conveniently admitted of, and having put a value on each field, they agreed that the lands, so valued, should pass by regular yearly rotation through the possession of the parties interested: the sharer in possession making good the jumma of the field, for the year of his occupancy.

30. This account is merely traditional, but I have no doubt that it is correct, and that the *Pouth*, like the Khetbut tenure, has been resorted to, as a means of equalizing the holdings in regard to soils.

31. This peculiarity of tenure, would appear not to have been noticed; but is at all events understood by the officers who prepared the settlement record. In some instances, the *Pouth* fields are represented as being held in *partnership*, but the nature of the partnership is no where explained. In other instances, the

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* NOTE.—The *Pouth* villages are not on the Jumna only, but on other rivers also,—Cane, Chundrawul, and Baghin.—M. P. EDGEWORTH,
4th March, 1849. *Collector.*

Pouth field is entered under the name of the sharer who was in possession during the year when the record was prepared, without any mention of other interests; and, as the value of the *Pouth* fields was added to his portion of the jumma, and no provision was made for his payment decreasing, when the field left his possession he very naturally refused to give it up; and, as may be supposed, disputes and balances ensued.

32. A paper has now been filed in each missil, shewing the number of the *Pouth* fields, the amount of jumma which they bear, the names of the sharers through whose possession they pass, and the year of possession of each sharer. It is only I believe in the six villages mentioned in the margin, that the *Pouth* tenure now exists.*

Pergunnah.	*Village.*
Pylanee, ...	Nundadeo.
Ditto, ...	Amara.
Dursenda, ...	Sukrowly.
Ougassy,..	Jillalpoor.
Ditto, ...	Gama.
Ditto, ...	Kubeerpoor.
Dursenda, ...	Sindoora.

33. The preceding remarks will serve to shew the nature of the errors committed in the settlement proceedings. I will proceed to notice the extent of those errors, and to consider the effect which these may have had, in causing the financial disorganization which followed the settlement.

34. The total number of villages, which have come under my notice for revision of the record of holdings and liabilities, amounts to 198. Out of that number there were found to be 104 cases in which the settlement arrangements had been set aside by the people themselves, or which required alterations; and out of the 104 cases so altered, or requiring alterations, the errors, in 31 cases, arose from the holdings being wrongly entered in the khuteonee, and had nothing to do with the Burrar question, further than that a distribution of jumma made upon false *data* could not of course be upheld. In the remaining 94 cases, the objections urged by the people, were either dismissed as untenable, or were removed, by the permission to adjust their village expenses, as usual, at the end of the year according to the village Burrar.

35. The proceedings of the Settlement Officer may be divided into *what he did* and *what he attempted to do*. *What he did*, was, to adapt the *rate* to the actual holdings; and this was nothing more than what, according to the nature of the Bhej Burrar tenure, it was his duty as Settlement Officer to do. There were errors in the manner in which this was done; but these were not difficult of remedy, and were in several cases remedied by the

* Others have been since detected.—M. P. EDGEWORTH, *Collector.*
5th March, 1849.

people themselves. When the holdings were wrongly entered in the khuteonee, a Burrar, based on these wrong entries, was of course erroneous; but these erroneous entries did not alter actual possession, and it was impossible to prevent the people, if they desired it, from making a new distribution of jumma, in accordance with their real holdings. Again, when the settlement proceedings were objected to, on the ground that the old and unequal Burrar had been maintained, it must be remembered, that the people were not thereby worse placed than they were before. The only difference was, that the measurement had, by developing the inequality, given cause for discontent. Although, therefore, the errors which I have already noticed, were calculated to cause some temporary confusion, I do not think that they were sufficient of themselves to occasion any actual loss of revenue; because, what is looked upon as the defect of the Bhej Burrar tenure, viz., its liability to change, afforded a ready remedy, where the desire to apply it existed: and had the administration which followed the settlement, been strong and efficient, I believe that the people would have applied that remedy, and would of themselves have made the necessary changes: instead of, as they did, encouraging confusion for the purpose of withholding the revenue.

36. What the Settlement Officer *attempted to do*, was, to abolish the liability of the rate, to change; and it is to this attempt, or rather to the misunderstanding which arose from this attempt, that in my opinion any difficulty in collecting the revenue, which had its origin in the settlement proceedings, is to be ascribed. I shall proceed to explain how.

37. The distinctive feature of the Bhej Burrar tenure, is a closer system of joint responsibility and mutual combination, than marks coparcenary tenures in general. The tendency of the Settlement Officer's proceedings, or, at all events, the effect of the interpretation put upon them, was to loosen, if not dissolve, this close bond of union; and hence, in my opinion, has arisen this mischief.

38. Mr. Wright (in his remark on this tenure, page 23) says, "The amount which every man has to pay from the year "of settlement to the end of his 30 years, remains neither in doubt, "nor with the chance of alteration, whether his lands are cultivated "with the utmost skill, or allowed to fall off into waste:" and again, (page 24,) "now, a man stands or falls by his own industry."

39. These remarks cannot, I think, be applied with strict correctness to any system of village administration, whilst the principle of joint responsibility, which is both the custom of the tenure and the law of the country, remains in force. If A falls into arrears and cannot pay, B however industrious, must pay for A or fall with him.

40. However, the principle thus announced by the Settlement Officer was diligently instilled into the mind of the people and native

officers, and was literally understood. A statement of his liability was given to each sharer, and he was led to believe that when he acquitted himself of that, he was free from all further demand. Instead of paying through the lumberdar, as before, he carried his kists to the tehseeldar, and received his own receipts; and, when his receipts covered his individual liability, he considered all his troubles for the year to be over; and refused to pay any remuneration to the lumberdar, on the grounds that the interference of the latter had not been required. The lumberdar, deprived of his perquisites, naturally ceased to concern himself about any interest except his own; whilst the tehseeldar, acting on the same principle, restricted his demand to the individual defaulters. The result of the system of administration was, that almost every coparcenary village in the district fell more or less into arrear. The defaulters could not pay. The broken down puttees held out no sufficient inducement to strangers to buy or farm; and the solvent sharers, unmolested on account of the balance, never troubled their heads about the difficulties of their insolvent brethren.

41. Eventually, when the solvent sharers were summoned, and desired to make arrangements for the arrears, they produced their receipts, and said that they had nothing to do with the balance. They were asked what they would have done previous to the settlement in a similar case. They admitted that previous to the settlement, they were bound to make good the deficiency of their defaulting sharers; but they said "all that, has been changed now:" in their own words "*tub gaon, Bhej Burrar tha; ub thoke puttee ho gea;*" (then, the village, was *Bhej Burrar;* now, it has become *thoke puttee.*) It was in vain, to tell them, that no settlement arrangement could abrogate the law; so impressed were they with the conviction that the effect of the settlement had been to abolish the custom of joint responsibility, that it was not until several muhals were transferred, and the transfers were confirmed, that they discovered their mistake: and when they did discover their mistake, the rapidity with which the balance was forthcoming, when a farming tender was procured, shewed that there was no want of funds amongst the community.

42. Before concluding this report, I will state the impression which the present investigation has left on my mind, regarding the working of the Bhej Burrar system, and the expediency of attempting to abolish it.

43. After a careful consideration of the whole subject, I cannot help thinking, that those Officers who see nothing but evil in the Bhej Burrar tenure take a one-sided view of the question, and commit a mistake in regarding it as a custom, adopted by the people of their own free will, instead of what I believe it to be, a necessity to which the people have been reduced by circumstances beyond their control.

44. A brief review of the effects of our revenue administration of the Banda district, will I think, bear me out in saying, that the Bhej Burrar system has had its advantages, as well as its disadvantages; and therefore, in questioning the expediency of attempting to introduce any sudden change.

45. In the early part of our rule a false idea of the fertility of the soil, and of the profits derived from the land, caused numerous speculators to flock into the district, and gave origin to a spirit of competition which soon raised the demand for land much above its value. In the struggle which ensued, between the old proprietors and the new speculators, the former must often have experienced the benefit, or rather necessity, of a system of combination, which enabled them to resist intrusion so long as any capital remained amongst the community.

46. Amidst the innumerable sales and transfers, which followed the extravagantly high assessment of the fifth settlement, and which after the general introduction of kham tehseel management ended in a reduction of assessment to the amount of 5,00,000 Rupees, the peculiarity of the tenure was admirably adapted to enable the old proprietors to regain possession, when any favorable opening presented itself. It is a common complaint amongst the sale purchasers (*mooshturees* as they are called) that the reduction of jumma given by Mr. Begbie, has rather embarrassed than benefited them; and they explain this by saying that the proprietors who were forced by the extravagantly high rate of the fifth settlement to abandon their own lands, and cultivate elsewhere as ryots, returned to their own villages, after the reduction, and thus caused a dearth of cultivators on the estates owned by single proprietors. Under ordinary circumstances, a proprietor, having once left his holding, would experience much difficulty in re-establishing himself amongst the community; but under the Bhej Burrar tenure however long a sharer may have been absent, if more favorable prospects induced him to return to his village, he was welcomed back, and allowed to help himself to what portion of the common bunjur he could cultivate. His cultivation became his holding; every beegah he ploughed relieved his brethren from a portion of their burden; and if he was industrious and successful, he might in a few years, by his own efforts, become the largest proprietor on the estate.

47. In the same manner, after kham management, or, after the restoration of a village to the old community, the custom of the tenure did away with all difficulty and delay in taking re-possession. The jumma was distributed over the cultivation; the culturable land was common: and if the absentee sharers who in the interim had scattered themselves over the country, chose to return and break up the bunjur, a new distribution of jumma took place and the whole were benefited: because the rate or Burrar, became lighter

as the cultivation increased. In short, the pliancy of the Bhej Burrar tenure enabled the people to bend before any calamity, and when the storm was over to stand up again, if not exactly in the same place as they before occupied, at all events on the same ground.

48. One objection which has been urged against the custom of the tenure is, that the lumberdar, with the aid of the putwarree, very often levied a larger amount under the head of village expenses than was actually incurred on that account. There is no doubt that in favorable seasons the lumberdar does occasionally collect more than the village expenses of that particular year, but then it must be considered that in years of distress and difficulty, it is the lumberdar who has in the first instance to bear the loss. If a sharer becomes insolvent, the lumberdar makes good the deficiency. If he can, he repays himself by a rate at the end of the year; but if the season is a bad one, the sharers may be unable to make good that rate; and this may happen for several successive years. It is only reasonable to suppose, that, when a good harvest does come, the lumberdar will take advantage of it, and endeavor to recover his past losses; and the cause of the increase in the village expenses on such occasions is perfectly understood, and its fairness acknowledged by the other sharers. The lumberdar, in fact, in these villages is what he should be; a person comparatively of influence and capital, to whom the community can look for help in times of distress: and one of the disadvantages of the settlement arrangements, certainly was, that by giving a false idea of their own independence to the inferior sharers, it tended to destroy the good feeling which formerly existed between them and the head of the community.

49. But the strongest objection of all to attempting to abolish the peculiarity of the Bhej Burrar tenure, is, that the attempt must fail, unless the people are prepared to receive the change. Undoubtedly, favorable seasons, and an increased population, will tend to make land more valuable, and consequently property in land more fixed; but this change will be the work of time and circumstances, and cannot be suddenly introduced by the wording of a record. The settlement record says, in future every man's land and jumma is to remain as here recorded, and if a man does not pay his portion of the jumma he is not to be relieved by the other sharers, but his land is to be transferred. But, suppose that A's cattle should die, and that he is unable to cultivate the land recorded under his name, and that B, C or D with A's consent, take his waste land off his hand, and, having restored it to cultivation, make a fresh distribution of jumma; how is such a transaction to be prevented? or, if it could be prevented, why should it? and if it is not prevented, what becomes of the clause ordaining that there shall be no further change in the holdings and jumma? Again, suppose that A cannot pay his jumma, and that B, C, or D, do not choose to take his dete-

riorated land ; but that, to prevent their own land from being transferred along with his, they raise A's balance amongst themselves, and take it to the tuhseeldar : is the tuhseeldar to say "No, I will not take A's balance from you, unless you take A's land ?" or, if he is to say so, how can he prevent B, C and D from paying A's balance in A's name ? If the system of joint responsibility were to be discontinued, the official enforcement of the settlement arrangement might be practicable. Under a system of joint responsibility, it becomes a mere nullity, except in so far as the people themselves are pleased to exercise it.

50. In many cases the settlement arrangements have been successful, in so far that there has been little or no deviation from them hitherto ; but it must not therefore be inferred, that these arrangements have become permanent. The Bhej Burrar tenure, is a shift to which the people are occasionally reduced, to enable them to fulfil their joint engagements and retain their possessions. Its tendency is to be concealed in seasons of prosperity, and to reveal itself in times of distress. It may be dormant for many years, if the seasons are favorable ; and when to all appearance it has become extinct, one bad harvest may bring it back into full operation. If the settlement officer records things as he finds them, I believe he will do all that be can do with advantage. He must leave to those who follow, to watch and record the changes which the tenure will afterwards assume.

51. I beg to refer to the *Appendix*, where I have given a brief account of the tenures, and effect of the settlement arrangements, in five villages with the view of illustrating the foregoing remarks.

APPENDIX.

No. I.—Mouzah Toora, Pergunnah Budousa.

The village is held by a coparcenary community of Brahmins. The tenure cannot be traced back beyond 1863 Sumbut. In that year a measurement of land and distribution of the jumma was made. The bhyachara beegah then used, was equal to three of the common or paemashy beegahs.

2. There is no record of this measurement. At this time there were two thokes ; one held by Bheekum, the other by Lulloo and Pershaud ; each thoke had its portion of jumma assigned to it, which was levied by an equal rate, annually distributed over the cultivation.

3. This continued till 1241 Fusly; when the zemindars resigned, and the village came under kham management. It remained kham for three years.

4. On being released from kham management, in 1244 Fusly, a measurement was made, and considerable changes took place in the administration. Lulloo and Pershaud split their thoke into two. The result was as follows :

Thoke.	*Land.*	*Jumma.*
Bheekum,	912	1,800
Lulloo,	536	1,400
Pershaud,	3500	1,200

5. The bhyachara beegah employed on the calculation, was equal to two of the paemashy beegahs. In Bheekum and Lulloo's thoke, only the cultivated land was taken into account. In Pershaud's thoke, which had become much deteriorated, the land thrown out of cultivation was also calculated.

6. The jumma on the thokes of Bheekum and Lulloo, continued to be levied, as before, by a Burrar, calculated on the cultivation ; *but this Burrar was declared not to be liable as before to annual revision.*

7. In Pershaud's thoke, a great change took place. The Burrar sharers, it appeared, had previous to the introduction of the kham management become largely indebted to the thokedar ; and being unable to repay him, they were declared to have forfeited their rights to the privilege of a Burrar, and become mere cultivators, paying rent to the thokedar. In addition to these changes, the thokedar himself, to get rid of his own difficulties, sold two-thirds of his interest to a stranger named Bhudaree.

8. The mouzah, accordingly, at this time was separated into three thokes. The internal tenure of Bheekum's thoke was Bhej Burrar. But the Burrar was not liable to any change until a new settlement took place, unless defalcation occurred. The administration of Lulloo's thoke was the same as Bheekum's. The tenure on Pershaud's thoke had become zemindaree ; Pershaud having a four-anna interest, and the purchaser Bhudaree a 12-anna share.

9. In Pershaud's thoke no subsequent change took place. In the others the new arrangement only lasted one year.

10. In 1245 Fusly, defalcation occurred amongst certain Burrar sharers, in the thokes of Bheekum and Lulloo, an attempt was made by the thokedar to levy these arrears by a rate from the solvent sharers. This attempt failed ; and finally it was settled that the thokedars should make good the deficiency, and be responsible in future for the entire jumma ; the other Burrar brethren holding their lands at fixed rent rates. In short, an arrangement *similar* to, but not *the same* as, that which had been made in Pershaud's thoke in 1244 Fusly, was now carried into effect in the other two thokes ; and the Burrar sharers were for the time,

reduced to the condition of tenants holding under-pottahs from the thokedars. The rent rates were fixed at 1 rupee 4 annas per common beegah, for Kabur and Purmah soils; 1 rupee 6 annas for Ghond; 1 rupee for Dandee, and 4 annas for Bangur.

11. No further change took place till the present settlement, when the Burrar sharers on Bheekum's and Lulloo's thokes, claimed to be re-admitted to the Burrar. The thokedars allowed that the rights of the claimants were merely in abeyance, pending the payment of the arrears for 1245 Fusly with interest. To settle what the amount of these arrears with interest was, a punchayet was appointed.

12. The punchayet decided that, on Bheekum's thoke, Rs. 1,599 were due to the thokedar from the old Burrar sharers; and that Rs. 1,597 were similarly due on Lulloo's thoke. They assigned his portion of this balance to each sharer, and decreed, that, on payment thereof, he should again be admitted to hold under the Burrar in force. They, at the same time, determined the portion of jumma which each sharer, when so re-admitted, should pay.

13. Out of nineteen sharers affected by this decision in Bheekum's thoke, seven have paid, and been re-admitted; fourteen sharers out of 52 have done the same in Lulloo's thoke. The remaining sharers who have not yet paid, hold as before, at fixed rent rates under the thokedar, who is rated for these lands at the current Burrar, and appropriates the surplus.

14. The punchayet also decided, that, five of the old sharers in Pershaud's thoke, should be re-admitted to the Burrar, on paying Rs. 452 to the thokedar, but this is allowed to have been a mistake. Those sharers neither claimed, nor wished, to be so admitted. The punchayet took it for granted that the two transactions were the same; whereas, they were quite different. The forfeiture on the part of Pershaud's sharers in 1244 was a sale in perpetuity; the forfeiture on the part of Bheekum and Lulloo's sharers in 1246, was a mortgage liable to redemption.

15. There is nothing to find fault with in the settlement proceedings as regards this mouzah. My principal reason for entering into its history, is, that it is the only instance, I have met with, of the rights of a whole Burrar community having become temporarily or permanently forfeited to the lumberdar, for the defalcation of the sharers of a part. In this case, the lumberdar first adopted the course of throwing the balance into the village expences, and attempting to levy it from the solvent sharers. Had this attempt succeeded, no change would have taken place in the administration, but, the solvent sharers being unable to bear the burden of the balance, the Burrar rights of the whole community became vested in the lumberdars. In the case of Pershaud's thoke, the lumberdar became proprietor. In the case

of Bheekum and Lulloo, the lumberdars became mortgagees. In their own language, they took their thokes into kham management. This is almost precisely our present law of joint responsibility; the Government standing in the place of the lumberdar.

16. The history of the village is also curious, as exemplifying the changes to which the Bhej Burrar tenure is liable.

No. II.—Mouzah Bumbhete, Pergunnah Cheboo.

This village is held by a community of Brahmins. The tenure is perfect putteedaree, and the jumma is liable to a fresh distribution at the time of settlement. Instances have also occurred, of a distribution of jumma having been made within the term of a settlement, but these were looked upon as exceptions to the general rule. The distribution was made by an equal rate over the cultivation.

2. The last distribution was made in 1214 Fusly. The cultivation was then estimated at 971 bhyachara beegahs.

3. At the time of the present settlement, a new distribution was not allowed, although the proportions of cultivation had varied much since the previous settlement.

4. The following extract from the record, shews how unequal the old distribution of jumma was, with reference to the existing cultivation:.

Name of Sharer.	*Extent of Cultivation.*		*Portion of Jumma.*		
	Bgs.	*Bis.*	*Rs.*	*As.*	*P.*
Jodee, ...	21	0	0	10	0
Jumoh, ...	4	2	4	9	0

So that, whilst Jodee held his land by paying about half an anna per beegah, Jumoh was made to pay one rupee two annas per beegah for his.

5. Disputes arose; balances occurred: and, when the estate was threatened with a transfer, the sharers appointed a punchayet who distributed the jumma, by applying one rate to the cultivation as shewn in the settlement papers.

6. By this arrangement every sharer pays a rate of 7 annas 5 pie per beegah on his cultivation, as it stood at the time of the settlement.

7. There is no doubt that this is a case where a new distribution of jumma ought to have been allowed at the time of settlement; because, the inequality in the rate was very great. It is true, the settlement left the sharer Jumoh, no worse than it found him; but then, Jumoh did not know how bad he was, till the settlement

measurement disclosed to him the inequality in the rate, besides it was the custom, before the settlement, to get rid of balances by a rateable contribution from solvent sharers; and, no doubt Jodee, who could well afford it, often helped Jumoh in this way. But the settlement abolished all that, "*Age Bhej Burrar, ub thoke puttee ho gea.*" Every man was to stand, or fall, by his own industry: a most comfortable doctrine for Jodee, but a ruinous arrangement for Jumoh.

No. III.—Mouzah Khujooreea, Pergunnah Cheboo.

The village is held by a community of Brahmins; the jumma is levied by an *annual* distribution made equally over the cultivation; the extent of cultivation held by each sharer, is calculated twice, in the year; once, after each sowing by an estimate, *tucmeenan*.

2. There is no permanent division of land: what each man cultivates, is his holding; but land, once allowed to become uncultivated, immediately falls into the common stock, and is occupied by any sharer who chooses to cultivate it; and pay the rate.

3. At the settlement, a punchayet was appointed to determine the future administration.

4. The punchayet first traced back the sharers to a common ancestor, and then assigned to each the share or interest which according to the law of inheritance, he was entitled to represent. They next calculated the portion of jumma for which each was to be responsible, in accordance with the newly declared sharers; and they recorded the land holdings, precisely as the cultivation was held in the year of settlement; although those holdings had no reference whatever to their division of jumma, of which the fractional shares had been made the basis.

5. This mode of proceeding, of course, caused immense inequalities in the new distribution of jumma; as will be seen from the following extract from the record of settlement.

Names of Sharers.	*Ancestral Share as declared by Punchayet.*	*Holding of land in Beegahs.*	*Portion of Jumma calculated on ancestral Share.*
	Rs. A. P. ꝛ.		Rs.
Debee, ...	0 2 0 0	25	81 0 0
Ramnath, ..	0 0 0 10	66	2 0 0

So that Debee, merely because the punchayet pleased to record him as a 2-anna sharer, was expected to pay, for 30 years, a rate of upwards of three rupees per beegah for his land; whilst Ramnath, who was fortunate enough to have only 10 gundahs assigned to him as his interest, was allowed to hold his land at the comparatively low rate of 4 annas per beegah.

6. This unfair division of jumma caused some confusion at first, but it was soon set aside by the people themselves, and the system of administration which existed before the settlement, was reverted to; in accordance with which the record has now been prepared.

7. The holdings and liabilities of the above two sharers, by the *tucmeenan* of the present year, are as follows.

Sharer.	*Extent of Cultivation.*	*Portion of Jumma.*
Debee,.....	39 Beegahs,	Rupees 27
Ramnath, ...	35 Beegahs,	Rupees 24

Being about 11 annas per beegah.

8. Had the punchayet in this case divided the land as well as the jumma, in accordance with their newly declared ancestral sharers, it is possible, although not probable, that their decision might have been acted on. The settlement officer must have imagined that this had been done, when he accepted and recorded the division.

No. IV.—Mouzah Oomree Behut, Pergunnah Cheboo.

This village is held by Brahmins and Rajpoots. The Brahmins occupy about a third of the area, and the remainder is in the hands of the Rajpoots. The tenure was, till 1818, perfect putteedarree; the jumma being liable to distribution, by the application of an equal rate to the cultivation, at the time of settlement; and intermediately, if necessary.

2. In 1818 the Rajpoots sold their land, to a stranger, Ram Purshad, under whom they continued to hold their lands at rent rates.

3. In 1832, Ram Purshad's lands were brought to sale for balances, and purchased by Government. These lands were subsequently let in farm, and the farmer greatly increased the rent rates of the Rajpoot cultivators.

4. The farmer resigned his engagements at the present settlement, and the settlement officer restored the zemindaree rights to the Rajpoots, who had continued in occupancy of their lands as cultivators.

5. A reduction of jumma was allowed at the settlement, but in distributing the new jumma instead of pursuing the old method of applying an equal rate to the existing cultivation, the old rate or Burrar was adhered to in the Brahmins' thoke, whilst in the Rajpoots' thoke, the jumma was distributed in accordance with the increased *rent* rates exacted by the farmer.

6. This mode of proceeding was of course very favorable to the Brahmins; as is shown by the following extract from the records.

Name of Sharer.	*Brahmin's Thoke; extent of Land in Beegahs.*	*Jumma.*
Mypal, ...	82	49
Dwarka, ...	28	22
	Rajpoot's.	
Boosey, ...	14	20
Cheda, ...	21	22

Making the rate in the Rajpoots' thoke nearly double of that in the Brahmins.

7. This inequality gave rise to disputes and balances. The jumma has now been distributed on the old system, and all pay alike, a rate of 12 annas 9 pie per beegah on their cultivation, as recorded in the settlement papers.

No. V.—Mouzah Bagahee, Pergunnah Terohan.

The proprietors of this village are three Brahmins; Petumber, Oojoodheea, and Kamptadad. Oojoodheea has an 8-anna share, and each of the others has a 4-anna interest.

2. The cultivating community, consists of Brahmins, Rajpoots, Chamars, Aheers, Lodees, and Kachees.

3. The administration is as follows. A portion of indifferent land in extent about 400 beegahs, is yearly let to such cultivators as agree to give the highest rent. The rental derived from this land is first carried to account, and the deficiency, required to make up the jumma, is distributed by an equal rate over the remaining cultivation, whether held by proprietors or cultivators. The only profit which the three zemindars receive in distinction to the other cultivators, is Rs. 100, which is yearly added to the village expences; and of which, the 8-anna sharer gets Rs. 50 and the others Rs. 25 each.

4. The bad land yearly let, is called *kum kholka*. The remaining land is termed *arazee Burraree*. In the former, possession is yearly liable to change; in the latter, occupancy is permanent, so long as the Burrar is paid.

5. At the settlement the area was divided into three thokes corresponding with the extent of interest of the three Brahmin proprietors; and a jummabundee was formed, by recording the holdings and payments of the cultivators, as they stood during that year.

6. This arrangement was never carried into effect by the people, and the administration remained precisely as before.

7. Had there been no peculiarity in the tenure of the cultivator in this village, the division of the land into three thokes, cor-

responding with the ancestral shares of the proprietors, would very probably have succeeded. But, constituted as the village administration was, the settlement arrangement was satisfactory to neither party. The cultivators were dissatisfied with it, because, it abolished their prescriptive right to participate in the village Burrar, and deprived them of all interest in the *kum kholka* lands. Before the settlement, their yearly payments depended upon the letting of this land. If it let badly, the Burrar fell heavy; if it let well, the Burrar fell light: and if it were even to happen, that the rental of the *kum kholka* land should cover the whole demand, the cultivators of the *arazee Burraree* would then have to pay nothing except Rs. 100 to the zemindars. The settlement arrangement if carried into effect, would have abolished these privileges, and would have reduced the *Burrar* cultivators, to the condition of cultivators holding at fixed rent rates. The zemindars, again, were dissatisfied, because a rental leaving them a profit had not been formed. In recording the new jummabundee, the payments of the year were upheld; and as the rental of the *kum kholka* land, together with the proceeds of the *Burrar* on the *arazee Burraree* of course exactly corresponded with the jumma, there was nothing left over for the proprietors.

[Mr. Rose's Report, not having been despatched at the time of his decease, the above copy was submitted and attested by

M. P. EDGEWORTH,
Collector.]

No. XXXV.

TIHARA CANAL.

Project for cutting a Canal from the left bank of the Sutlej, near Tihara, below Loodianah.

No. I.—Preliminary Note.

The following survey and project originated from a suggestion by Major Baker in his report to the Military Board, dated September 24th 1841, which was printed in a collection of papers entitled, Reports on Projected Canals in the Dehlie Territory, 1 vol. folio, Allahabad, 1842. In page 40 of that publication the subject is thus noticed:

"An immense benefit might be conferred on a large tract of country, at a comparatively small cost, by opening a Canal from the head of the Sookha Nuddee, calculated to flow during the periodical rise of the river in the rainy season; and perhaps also by the smaller increase of water which takes place from the melting of the snow in May and June. No work would be required at the head, except the excavation of a wide channel, into which the water would flow when the river begins to rise. The channel would require to be extended for a few miles, through the higher land bounding the Khadir, and might then be connected with one or more of the natural hollows or lines of drainage; some of which, under the names of "Nyewal" and "Waharlee," were traced by Captain Brown, and are marked in the general Map, (sheet No. I); and two more were met with in my level from Bullowalla to Ferozepoor; one of remarkable profile near the village of Boorra, and the other called the "Peeawala Choya," (sheet II. fig. 2). Supposing, for instance, that branch of the Nyewal to be adopted which passes Ubohur, we know that the difference of a level between that town and the head of the Sookha Nuddee is 120 feet, in about 90 miles, which would give a fall nearly equal to that of the Sutlej itself. A channel of 100 feet bottom width being provided, and average head water of 6 feet being assumed, (I saw flood marks 10 feet above the cold weather level of the Sutlej), a supply of water, amounting to upwards of 2,000 cubical feet per second, might be obtained during three or four months of each year.

"The effect of such a body of water being thrown over a dry country where rain is scanty and unfrequent, though not accurately estimable in money, will be easily conceived to be very considerable. By side-cuts, the water might be drawn off for the irrigation of khureef crops, and the preparation of the soil for those of the rubbee. A great portion of the water would remain in tanks and hollows, for the use of men and cattle during the dry months; and even what may be absorbed in the soil would reinforce the under ground springs, diminish the depth of water in the wells, and probably render sweet and wholesome many of those which now, over a large tract of country, are so impure and offensive, that none but natives of the soil can drink the water with impunity. Furthermore, there is perhaps ground to entertain a hope, that the measure suggested might even have a favorable effect on the quantity of rain. In the connexion which is always observed between the want of rain and barrenness of soil, the former is probably not altogether the cause of the latter; some mutual reaction probably takes place between them, and thus it may happen that a country of which the vegetation has been destroyed by a succession of drought, may for that reason be more liable to a recurrence of the evil, which in its turn would retard or prevent the renewal of fertility; and thus by a gradual process of deterioration, the country might become a waste, such as Bhuteeana now is. From the existence of the river beds traced by Captain Brown, unconnected as they are with any mountain range, and shewing by the remains of towns along their course, that at no very distant period they were flowing streams, we may safely infer that these districts once enjoyed more abundant rain; and we may venture perhaps, to hope, that this blessing may in some degree be regained, by restoring fertility to a wide tract of country, the surface of which would also be cooled by the evaporation of a large body of water.

"The cost of such a work may be roughly estimated as follows:

"For excavation of a channel 100 feet wide, through the high bank of the Sutlej, and clearing away obstructions, &c. &c. in the old beds of the rivers, about Rs.	40,000
"For the construction of two bridges; one a regulator on the Loodianah and Ferozepoor road, and the other on the Military road from Ferozepoor to Dehlie, or Kurnaul, at Rs. 5,000 each,.....Rs.	10,000
amounting altogether to.....Rs.	50,000

" Of which sum, a considerable portion might be contributed by the Sikh chieftains, through whose lands the water must necessarily flow before reaching Bhuteeana.

" For the preparation, of a more accurate estimate, and the determination of the best lines, a further examination of the ground, and a register of the height of the river for 12 months, would of course be requisite; but the above detail may suffice to enable the Military Board to estimate the value of the suggestion. On this subject, I will merely add, that in the Buhawulpoor territory, there are numerous canals, dry in the cold weather but filled by the periodical rise of the Sutlej; and that Captain Brown, Revenue Surveyor, who is thoroughly acquainted with the province, has expressed a decided opinion in favor of 'the measure.' "

Political events which have since occurred on the N. W. Frontier, have diverted the attention of the Government from this subject, and no further steps have yet been taken towards maturing the project. The reports are peculiarly interesting, as throwing additional light on the physical features of that singular tract of country, which extends along the left bank of the Sutlej from the Himalayah range to Scinde.

No. II.

Letter from MAJOR W. E. BAKER, *Superintendent of Canals, No.* 122, *dated Roorkhee,* 27*th May* 1847, *to the address of the Secretary of the Military Board, Fort William.*

SIR,

I have the honor to forward, for submission to the Military Board, a report, accompanied by Map and Profiles, by Lieut. C. J. Hodgson, Engineers, on the Canal proposed to be taken from the Sutlej, between Loodianah and Ferozepore, for the irrigation of part of the Cis-Sutlej Sikh Territory, and of the Bhuttee States.

Forwards Report on Tihara canal.

2. Lieut. Hodgson has turned to good account the short period of time which intervened between his appointment and the commencement of the hot weather. His enquiries having been judiciously directed and prosecuted with vigor, have determined the true point at issue, and at the same time have brought out some interesting and important features in the topography of the country.

The object of Lieut. Hodgson's Survey attained.

3. The plan suggested in my former Report on Sutlej irrigation, (dated 1841), and approved by Government (conditionally on its being found capable of execution for the amount of my rough estimate, viz., 50,000 rupees) was, briefly, the excavation of a canal, from the Sutlej through a strip of high land bordering that river, to one of the natural hollows or depressions traversing the country from north-east to south-west.

Plan suggested in 1841.

4. The grounds of this suggestion, were, the existence of certain dry channels, in the interior of the country, and the ascertained fact, that the ultimate difference of level, bore such a proportion to the distance, as to admit of a sufficient slope being given to the canal bottom.

Grounds of suggestion.

5. The success of this measure would depend upon the direction of the natural hollows, and the levels of the country lying between them and the Sutlej. To these points Lieut. Hodgson's attention was chiefly directed.

Conditions of success.

6. The result of the examination is unfavorable to the project. The directions of the natural channels are suitable enough, but the excavation required to connect them with the Sutlej could not be effected for less than four lakhs of rupees, or 8 times the amount to which Government has limited the expenditure for this object.

Result unfavorable.

7. The chief obstacle appears to be the continuation, in land, of the high bank which borders the Sutlej from Roopur to Loodianah, and was supposed to cease at Bhoondri (otherwise called Bhoondelee.) This bank has been traced by Lieut. Hodgson, and is found to be continuous; passing by Moodkee, Mokutsir, &c., and joining the high bank or "Dunda" at Nowkheira, surveyed by Captain W. Brown, 1840, and forming the boundary of the Bhuttee and Bhawulpoor states, west of Ubohur. There is every reason to believe, that the foot of this bank was once washed by the Sutlej, though now more than 20 miles distant from that river.

Nature of the chief obstacle.

8. Referring the Military Board to the accompanying report, for further particulars regarding the features of the country examined by Lieut. Hodgson, I now proceed to point out the line, and to estimate roughly (from Lieutenant Hodgson's measurements) the cost of a canal capable of feeding the Nyewal and the Furreedkote and Nowkheira nullahs, and of irrigating the districts of Ubohur, Kotekapoora and Furreedkote,

Object still attainable, but at greater cost.

though not attainable at the cost originally contemplated, it still remains for Government to decide whether the object be worth the additional outlay now found to be necessary.

Situation of canal head and fall to Chogana. *See Sketch Map.*

9. The head of the canal would be established under Bhoondri, at a point on the Sutlej where the flood level is 21 feet above the bottom of the nulla at Chogana, at a distance of about 20 miles. Deducting 6 feet for the depth of water, we have a clear fall of 15 feet, or about 10 inches per mile. The excavation on this line would be 11 feet deep, which with a bottom-breadth of 100 feet, and a length of 20 miles would give cubic feet 128,937,600.

Mokutsir and Ubohur branchea.

10. From Chogana a portion of the water might be allowed to flow towards Furreedkote, Kotekapoora, Mokutsir, &c.; and the remainder, for the irrigation of Ubohur, &c., might be conveyed by a canal to Bugta on the Nyewal, a distance of 24 miles, following the course of the Chogana nullah to Pulwana. The fall in this distance would be 26 feet, or 13 inches per mile. From Pulwana to Bugta, 20 miles, average digging 8 feet, bottom breadth 60 feet, would give excavation, cubic feet 57,446,400.

Abstract cost.

11. Total amount of excavation cubic feet 186,384,000, at 2 Rs. per 1000 cubic feet ..... Rs. 372,768
Add for 3 bridges, ... Rs. 15,000
and clearing out obstructions in old nullas, ... Rs. 12,232

Total Co.'s Rs. 400,000

No data for calculating return.

12. The preceding paragraph contains I believe a fair calculation of the cost of the work, but I have no data for estimating the probable returns. These might perhaps be ascertained from the Revenue Officers.

Disposal of Lieut. Hodgson's services.

13. Should it be considered expedient to expend four lakhs of rupees on this undertaking, Lieut. Hodgson will submit regular estimate for the work, as soon as possible after the rainy season. But if, on the other hand, the cost of the project be deemed conclusive against it, I would recommend that Lieut. Hodgson's services be transferred to the Ganges Canal.

I have, &c.,

W. E. BAKER, MAJOR,

Superintendent of Canals, &c.

No. III.

Letter from Lieutenant C. J. Hodgson, Executive Engineer, Tihara Canal, dated Loodianah 1st May 1847; addressed to the Superintendent of Canals.

SIR,

In my letters Nos. 2, 3, 4, and 5, I had the honor to inform you, that I had in levelling from Tihara in a S. W. direction, fallen in with a depression at Chogana, about 11 miles distant from my starting point, which I had again crossed near Moga, and again, as I imagined, in the neighbourhood of Moodkee; and that I had ascertained the existence of a "Dunda," or old river bank, running through the country from Furreedkote to Naokheira: further that I had traced the course of the westernmost Nyewal, from the neighbourhood of Mullote on the confines of Bhutteeana, to a village named Lapo on the Ferozepore and Kurnaul road.

Recapitulation of depressions mentioned in former letters.

2. I have now the honor to forward a general plan* showing the courses of these nullahs and banks, with profiles showing the relative levels of the Nyewal, and the Chogana and Furreedkote nullah, with the valley below the latter town.

Forwarding Plan and Profiles.

3. Since my former communications, I have ascertained that the Chogana and Moodkee depressions have no connection with each other, and have traced them both throughout their course; have examined the "Dunda" immediately above and below Furreedkote; and have also followed Nyewal to its commencement as a distinct nullah, concluding by carrying up my level to the fort of Loodianah as a fixed point.

Statement of nature of work since my last communication.

4. The nullah first met with by me at Chogana, and the Nyewal, may be said to have their commencement within 9 miles of each other; the one at Shekhopoora, and the other at Urkara; where they with another smaller depression, which afterwards joins the Shekhopoora and Chogana one, form the outlets by which the drainage of the higher country to the eastward (over which the water flows during the rainy season in wide uncertain channels) is carried off.

Origin and nature of the Nyewal and Chogana nullahs.

5. The depression from Shekhopoora, to Chogana, is, as far as Jettowal, of great width, having several villages built in the centre of its channel, and is generally from 5 to 6 feet below the surrounding country. But below that village it is more con-

General description of the Chogana nullah from Shekhopoora to Demoroo, throughout its course.

* *Vide Appendix.*

tracted, the banks being generally about 6 to 700 feet in length without increasing in depth; from thence it continues, with a winding course, but distinct profile (except for a short distance from Chundun to Chotiya) to near Demoroo, where it joins what would appear to have formerly been a river bed, which may be traced from thence to near Furreedkote.

General description of the nature of old river bed between Demoroo and Furreedkote with the continuation of its left bank to the northward as far as Sulleena.

6. This river bed, I first fell in with while crossing the country from Lopo to Furreedkote, and I then examined it throughout its length; but I have not surveyed it, and consequently am unable to lay it down with any accuracy. It is a wide and deep channel, averaging from ½ to 1 mile in breadth, with a continuous steep bank to the south, till within a short distance of Furreedkote, where it gradually loses its distinct character, and within the last mile becomes no longer distinguishable. The bed of it throughout, is very uneven, intersected with ridges, and filled with enclosures, so that without a considerable amount of clearance and excavation it would form a very wasteful channel. At present, it is represented that water never flows along it, and indeed, towards the end, the bed evidently rises. The bank to the N. only commences at Nuthoowala opposite the junction of the Nullah, while the S. and E. bank continues towards the north, and is in all probability a continuation of a bank of the same nature which I met with in my first line of levels from Moga to Moodkee near Sosun, and which I have since traced as far north as Sulleena, where I learned from the inhabitants that it commences near Esan-Khan-ke-kote; but, as it did not appear to me to be likely to be of any use to the purpose of the present enquiry, I did not follow it any further.

Rise and course of the depression from Sosun by Moodkee to the Dunda.

7. Below this bank, at Sosun, the nullah I had formerly crossed near Moodkee, takes its rise and runs, as shewn in the plan* to the Dunda, which it joins between Moodkee and Jundiala.

Account of the Dunda or old bank of river from Moodkee to Naokheira.

8. The earlier course of this Dunda I could not learn from enquiry of the natives; but the village of Moodkee is situated on the edge of it (though it is here rendered indistinct by accumulations of sand) and from thence it is to be traced very clearly by Jundiala Misreewala, Pukka, to Furreedkote; from whence it continues, as drawn in the plan, to Mokutsir and onwards to Naokheira. For a few miles, a bank runs (so to say) parallel to the Dunda; thus forming a valley

* *Vide* Appendix.

varying in width from ¼ mile, to a mile, and even to considerably more than that in parts.

Non-existence of any depression at the foot of the Dunda (by which water finds a channel) above Wuttoo.

9. In my letter No. 3, I informed you that I had been able to trace, at the foot of the slope of the Dunda, a continuous small basin by which the rain water finds a passage; but upon further examination I find that even this has no existence above Wuttoo (the village at which I rejoined the Dunda in my first line of level) but that the Dunda itself follows a very winding course, while the mouths of the bays thus formed are partially filled up with sand ridges, and above the latter town, though its course is regular, yet there is no appearance of any channel at its foot, while the fall is from Furreedkote; the lowest part appearing to be about Pukka, at which place are traces of a flow of water to the westward. Below Wuttoo, the Dunda is unbroken as far as Naokheira.

Consideration of facilities offered by these features to the formation of the Canal.

10. To consider, then, the facilities offered by these features for carrying water into the Bhuttee country from the Sutlej at Tihara:—

Levels of high and low water opposite Tihara.

11. The flood level of the Sutlej at Tihara to which the water rises and generally maintains itself during the rains may be taken (as far as I could learn) upon an average to be eight feet above the cold weather level; so that, allowing a head of 6 feet depth of water for a canal, the bottom level would be two feet above that of low water.

Statement of levels of points in the Chogana nullah, with lengths necessary for communicating cuts from the river and into the Nyewal near Ubohur.

12. The nullah at Chogana is 2½ feet below the low water level at my starting point (which was about 2½ miles below the head of the Sookha Nuddee) or ½ foot below the bottom level of the canal at that point. At Moga the fall is 12 feet, while the distance from Tihara is 16 miles, and a fall of one foot per mile is not gained till below Singunwala, a distance of about 22 miles. The nullah from thence has a clear channel, about 5 feet in depth, with long sloping banks 6 to 700 feet in length generally, with the exception of the space between Chundun and Chotiya, where the waters flow over a wide flat; but beyond Demoroo, but little advantage appears to be offered by the river bed and the Dunda as a channel must be formed for the whole distance to the point from which it might be considered most advisable to commence a communicating cut to the Nyewal, which would have to be 25 or 26 miles in length, and excavated to a general depth of 15 feet, as shewn by Capt. Baker's level from Ubohur to Katte.

13. The Nyewal nullah having been traced by Captain Brown in his survey of the Bhuttee territory, as high as Danawala in the neighbourhood of Mullote, I commenced my survey of it at that place, from whence I followed its course throughout to its rise.

Point of commencement of survey of the Nyewal.

14. My starting point was at the Sirsa and Ferozepoor road, where it crosses the depression, which has at this point an ill-defined profile. Immediately above the village of Danawalla, however, the depression assumes a more distinct character, which it preserves as far as Bhai-ke-kote, though the banks, which are here about 18 feet high, with a steep slope, diverge from each other to a mile or more distance, till near Tehree, where they suddenly approach to within 600 feet; beyond which the depth of the depression decreases to 6 or 7 feet, with a width of 14 or 1500 feet. Above Bhai-ke-kote, the high banks separate widely; that to the northwest running by Sahebchund and Pulayun to Uboloo, while the S. E. bank is again found at Memah. Between them however are several distinct channels, two of which branch off from each other below Uboloo; one running round by Sahebchund, and the other by Bisseeana; and I think it probable that a channel also joins from the eastward running under the high bank by Memah. Above Uboloo, the bank to the N. W. continues no longer so high, but the depression is clear and well defined, bounded by long sloping banks not less than 5 to 6 feet high, as far as Mullah. Between Mullah and Bugtah I could not find any continuous channel, though there are partial ones running in two or three directions. Bugtah is built in the middle of the channel, by which means the waters are thrown over a wide space, and Gooroosir and Pakrawadee are so also. From this latter village to Putto is a clear deep channel; but above Putto, the waters at present flow over a flat of great width, cutting small channels and pools in several directions. Near Lopo it is again confined between sloping banks $3\frac{1}{2}$ to 4 feet deep, and 500 to 600 feet long each, which is its general nature from its commencement at Urkara.

Description of the Nyewal throughout its course.

Here are collected the waters flowing from the eastward; and from the accounts I received it appears that this depression is not sufficient to carry off the water brought down during high floods, which consequently inundate the country to a great extent, while during the whole of the rainy season a stream, breast-deep, ordinarily flows as far as Lopo. After spreading over a wide expanse below this, the water, as plainly shewn by the traces left, flows with considerable force as far as Pukrawadee, from whence as far as Mullah, the country is said to be inundated generally during the rains. Below, this the stream is dependent upon

Nature of stream of water in it during the rainy season.

the nature of the season *in these parts*, being in good seasons not less than waist-deep during floods, and ordinarily throughout the rains continuing about ankle-deep, beyond Bhai-ke-kote. However, the inhabitants altogether reject the idea, that water ever flows along the depression, and at Mullote it is known as "the Jheel."

General level of the Nyewal with reference to the river.

15. The distance of Urkara from the river is not more than about 15 miles, but the bed of the nullah is not less than 25 feet above the river at the nearest point; and the relative levels of the river and nullah, are such, that water can in no part be brought into the latter, direct from the river, with a cutting of less than fifty miles in length.

Lengths of cuts required to bring water by the Chogana and Demoroo nullahs into the Nyewal at Sahebchund.

16. Nor do the Chogana and Demoroo nullahs offer much assistance; as the nearest point at which a channel can communicate from Demoroo will be at or near Sahebchund, a distance of not less than 28 miles; while I have above stated that the length of cut to admit water into this nullah cannot be less than 22 miles.

The section of country between Demoroo and Sahebchund not taken.

17. This appeared to me to be so little favorable to the project, that I did not think it advisable to delay for the purpose of obtaining the section of the country, between these two points, more especially as I had not at that time followed the Nyewal, sufficiently far, to have ascertained the impracticability of introducing water directly into it from a higher part of the river.

Reasons for supposing that no nullahs exist between the two traced.

18. That these depressions which I have been able to lay down, are the only features of the nature in this part of the country, would appear to be but little doubtful; as below Furreedkote no nullah joins the Dundah. No feature of the sort was met with by you in levelling from Bullawala to Kottee; while my level was run almost entirely along the north-west bank of the Nyewal, and I found no nullah joining it: and, lastly, any such depression, should it exist, must take its rise south of the road between Ferozepoor and Busseean, (in a country having a fall of not more than two feet to a mile,) as that road crosses no nullah: and, between the two depressions I have surveyed, there is another smaller one, which is traceable to Luugiana, where it unites with that from Chogana.

Course of levels above Arkara, with the closing point.

19. Above Urkara, finding only a wide plain, over which the waters sweep from the eastward, I ran a level across to Shekhopoora, and from thence followed the course, by which the rain-water flows, as far as

Munowr, from whence I brought it up to, and closed upon, the crest of the glacis of the fort of Loodianah, as a good fixed point, at which to commence or close any future survey; while it would be impossible for me to find, with any exactness, any point in your former surveys.

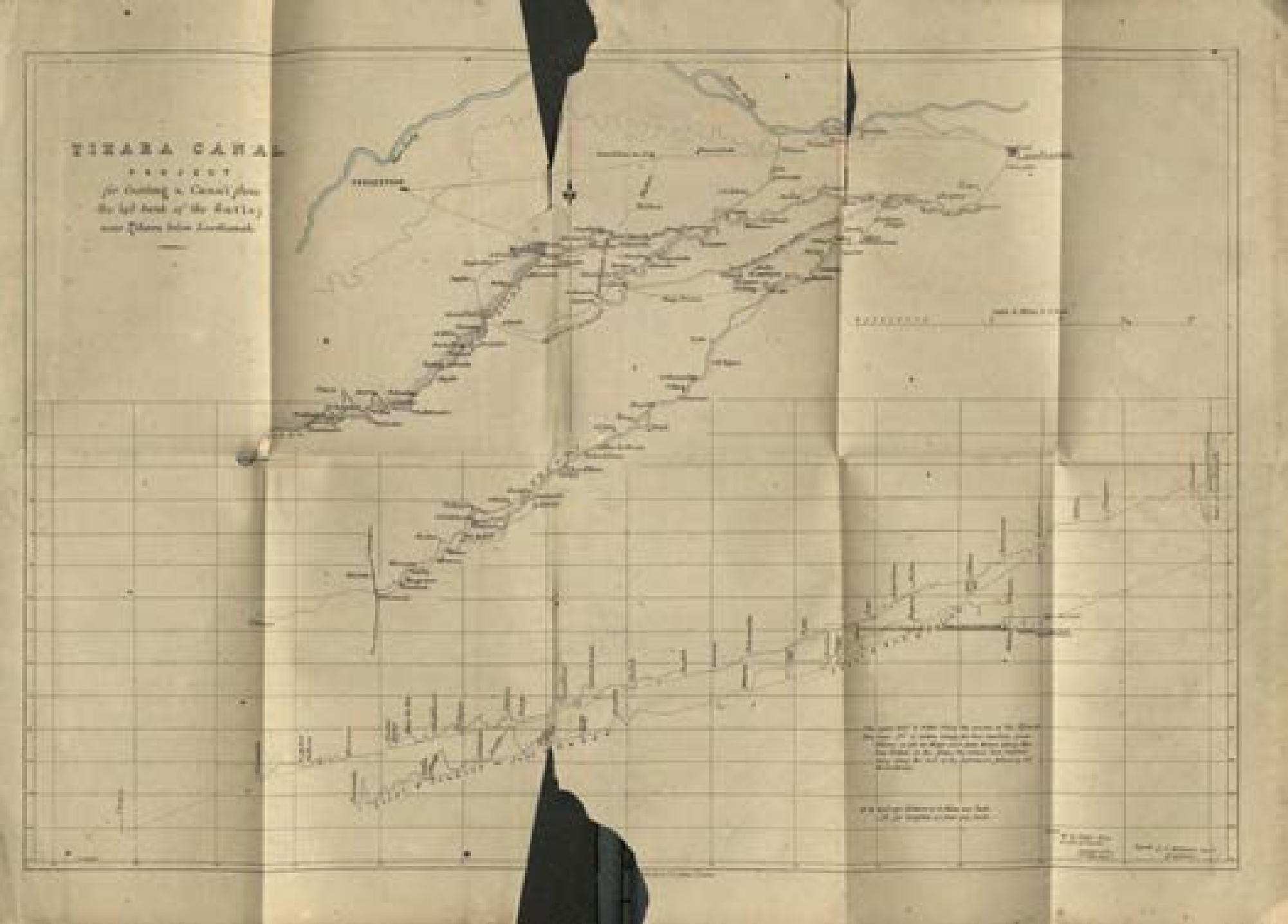
20. Should you require them, I can forward to you either copies of, or the original plottings and sections, as I have laid them down in the field, on a large scale.

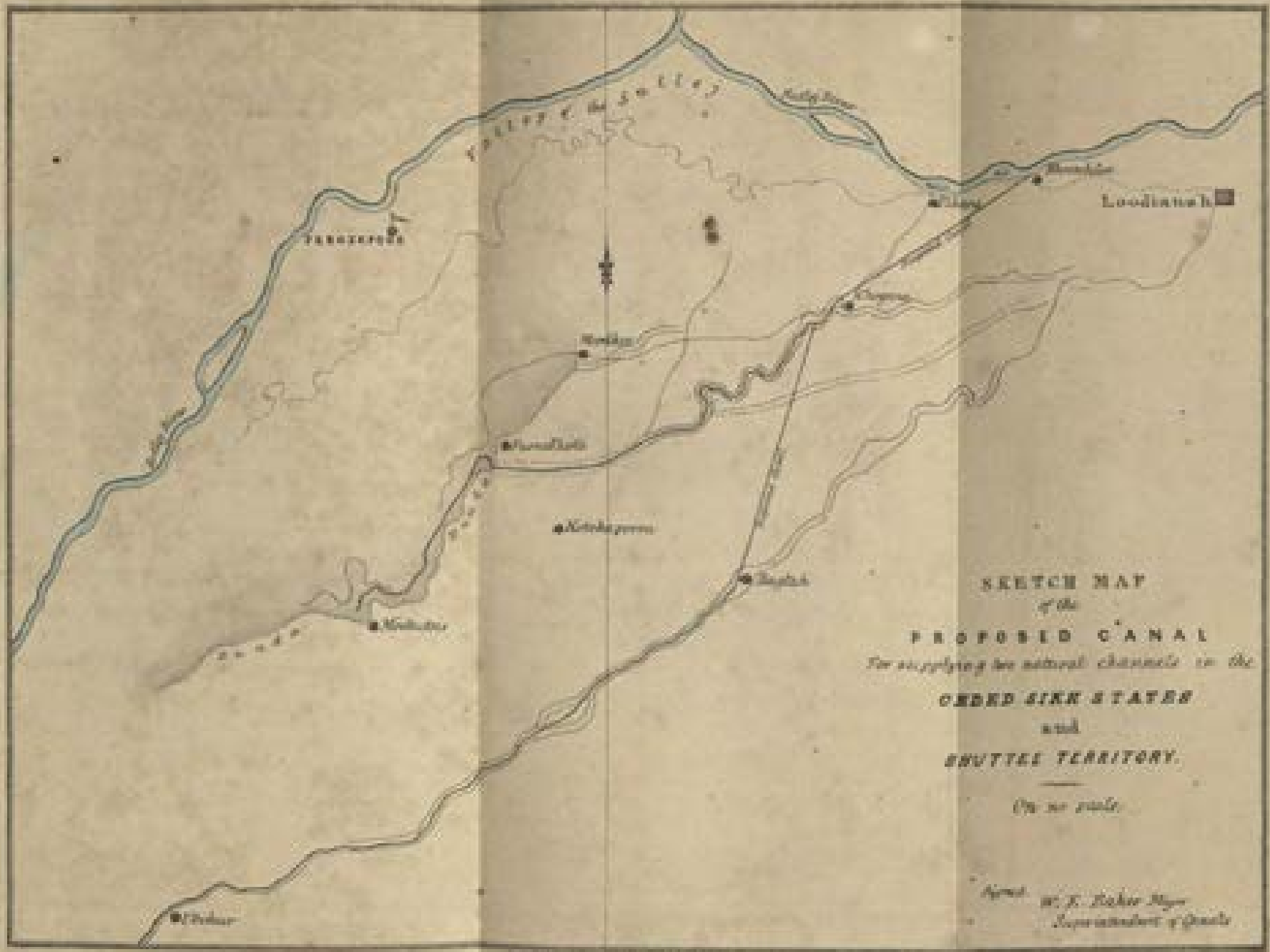
That copies of original plottings can be furnished.

I have, &c.,

C. G. HODGSON, LIEUT.,

Engineers.


TIKARA CANAL
PROJECT
for Cutting a Canal from
the left Bank of the Kuttay
near Tikara below Aurdhamuk


Loodiana
SKETCH MAP
of the
PROPOSED CANAL
for supplying the natural channels in the
CEDED SIKH STATES
and
BHUTTEE TERRITORY.
On no scale.
Agreed W. F. Richie Major
Superintendent of Canals

No. XXXVI.

MEMORANDUM OF EXPERIMENTS ON, AND ANALYSIS OF, SPECIMENS OF KUNKUR, FROM ABOUT THE 393RD MILE-STONE ON THE GRAND TRUNK ROAD, NEAR NAUBUTPORE, BY LIEUT. C. H. DICKENS, ARTILLERY.

Secrole, Benares, 19th Sept., 1849.

Two experiments were made on the hydraulic properties of the kunkur.

A, with the finer parts afterwards made into the square piece of cement.

B, with the coarser parts afterwards made into the triangular pyramid.

Both these were heated, nearly to whiteness, in crucibles for an hour, and then weighed; heated again for half an hour and again weighed: and after a third heating, having found no further loss of weight, the carbonic acid and water were concluded to have been completely expelled.

A lost 31·5 per cent. .. .. .. *B* lost 28·2 per cent.

In slaking, both swelled much, cracked, and gave out a good deal of heat. They were each made up (without any addition or grinding) into a stiffish mortar, formed into the shape above indicated, and immediately placed under water.

Examined, as follows:—

After	*A.*	*B.*
6 hours, ..	Not examined, ...	Had set.
12 ditto, ..	Had set,	
24 ditto, ..	Not examined, ...	Hardened, but could be marked by a strong pressure with the finger nail.
2 days, ..	Could just be marked by the nail, ...	Could not be marked by the nail.
3 ditto, ..	Not examined, ...	Grated under knife, but was not cut, to avoid spoiling specimen.
5 ditto, ..	Surface very hard and could be chipped off, after which interior cut like chalk,	
7 ditto, ..	.. ..	Removed to be sent to Major Willis.
10 ditto, ..	Removed to be sent to Major Willis,	

The specimens were considered to be set, when they did not give way to the blunt point of an iron pin, diameter 60·15 inches.

The experiments were not made simultaneously, though exhibited above as if they were so, for the sake of comparison.

The following is the result of chemical analysis :—

Carbonate of lime,.. ..	40·05		
Ditto of magnesia,.. ..	1·24		
Silica, ...	1·80		The sand contained some alumina, probably in igneous combination with the silica.
Alumina, ...	1·75		
Iron, ...	4·75		
		49·59	
Sand, ...	34·00		The loss,—probably in part from soluble salts, for which no examination was made.
Water, ...	13·36		
Loss, ...	3·05		
		50·41	
		100·00	

The first five ingredients are the active constituents of the mortar. Arranged in percentage of their sum, they stand thus :—

Carbonate of lime,..	81·1
Ditto Magnesia, ..	2·3
Silica, ...	3·6
Alumina, ...	3·5
Peroxide of iron, ..	9·5
	100·0

which approaches very nearly to some of the English and French "eminently hydraulic limes."

C. H. DICKENS, LIEUT.,

Artillery.

P. S. At the suggestion of Lieut. Grindall, I add the method used in the analysis.

1. One hundred grains of the kunkur, in small fragments, were placed in a glass flask, and an ounce of strong muriatic acid, diluted with an equal bulk of water, added; the flask being inclined to prevent loss by the effervescence. When the effervescence had ceased, heat was applied, and the liquor boiled for 2 hours. There remained a greyish white residue, consisting of sand and silica in minute divisions.

2. These were separated by pouring into a vessel 4 inches high, and giving the sand 3 minutes to settle, after which the finer particles, which remained in suspension, were decanted off. This process was repeated several times, till all the finer particles were separated. The remaining sand, by this time thoroughly washed, was dried, ignited and weighed. It amounted to 34 grains.

3. The turbid liquid containing the suspended silica was poured on a filter, on which the silica remained. Washed, dried and ignited with the filter, it weighed (allowing for the rest of the filter) 1·8 grains.

4. The clean liquor which had passed through the filter (including the washings) was treated with caustic ammonia in excess, to throw down the peroxide of iron, and alumina. The precipitate, separated by the filters and washed, was redissolved in muriatic acid, and again precipitated by carbonate of ammonia, so as to retain by the excess of carbonic acid any lime that might not have been separated by the first process. The precipitate was now washed, dried, and ignited. It gave the peroxide of iron and the alumina together 6·5 grains.

5. The clean liquors from the two filterings (in 4) were mixed, and threw down the lime as carbonate. Excess of carbonate of ammonia was added, and when the lime had all separated, the liquor was filtered from the precipitate; which, washed, dried, and gently ignited, gave 40·05 grains of carbonate of lime.

6. To the filtered liquor, from the above, was added phosphate of soda, which gave a slight precipitate of ammonia-phosphate of magnesia. The liquor, after standing 24 hours, was filtered; and the precipitate (washed by dilute solution of carbonate of ammonia,) dried and ignited, weighed 1·5 grains, equivalent to 1·24 carbonate of magnesia.

7. The precipitate of para: 4, was redissolved in muriatic acid, and the iron precipitated by solution of caustic soda, which retained the alumina in solution. The precipitate carefully washed, dried and ignited, gave 4·75 peroxide of iron. The alumina was given by difference.

8. The water was ascertained, by deducting the weight of carbonic acid, due to the lime and magnesia, from the total loss by heat.

9. The loss on this analysis, arose chiefly from the alkaline salts not having been estimated.

C. H. D.

SKETCH
of the
SYSTEM of IRRIGATION PREVAILING
in the
Upper Valleys
of the
KANGRA DISTRICT

a. Bundla Canal
b. Duban Canal
c. Cogur Canal
d. Kirpal Chund's Canal
e. Cut to Poondur
g. Cut to the village of Arluh
h. Cut to Munsumbha
i. Cut to Diroh
j. Cut to Bhooluh
k. Cut to Mondeh

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No. XXXVII.

CANAL IRRIGATION OF VALLEYS.

NOTES *on the* SYSTEM OF IRRIGATION *prevailing in the* UPPER VALLEYS OF THE KANGRA DISTRICT; BY G. C. BARNES, ESQ., C. S., *Deputy Commissioner, Kote Kangra, Trans-Sutlej States.*

[*The chief object in publishing this paper is to show, how the preservation of the Canals, and the distribution of the water can be provided for by the people themselves, in a district, where artificial irrigation has long prevailed.*]

Introductory remarks.

The district of Kote Kangra is divided from the hill-principality of Chumba by a chain of mountains rising to an elevation of 14,000 or 15,000 feet above the level of the sea. On the Chumba side this range is the first and lowest of a series which stretches into the depths of Tartary and Thibet. On the southern, or Kangra side, the base of these hills extends in long and gentle slopes towards the river Beas, forming a noble valley, highly cultivated, and thickly peopled, known by the local appellations of talooquas Pâlum, Putheeâr, Kangra, and Rihloo.

The tops of this chain are covered with snow for nine months of the year; and snow exists in the clefts and hollows all the year round. A number of hill streams take their rise in these mountains; and the waters, on their course to the Beas, are arrested by

the people, and conducted by means of canals to the cultivated surface of the valley.

The extent of this irrigated tract may be roughly estimated at twenty six miles long, by twelve miles broad: and notwithstanding that much land is still lying waste, and many villages are alienated in jageer, the revenue paid to Government does not fall short of 2,25,000 rupees.

Canal heads.

The canal heads are at all points of the stream. Those destined to irrigate the upper portions of the valley, lie deep in the interior of the hills; and the canal courses are brought along the hill side at a great outlay of expense and trouble. The lower cuts are much more easily constructed; and generally a distance of a few hundred yards suffices to convey their waters to the cultivated level.

Embankments.

The water is diverted from the main stream by means of the simplest embankments made usually of the stones in the bed of the river, cemented together with a few green sticks, and (where allowed by custom,) with clay. These embankments seldom extend quite across the stream, but are placed at favorable turns, where the excavation of a new channel, assisted by a partial barrier of stones, is sufficient to turn off the quantity of water required.

On each of these rivers there are at least fifteen to twenty independent canals leading to various villages to the right and left of the stream. Between one embankment and the next, the supply is renovated by plentiful springs in the bed of the river; and thus an abundance of water is furnished not only to the lowest canal, but a goodly stream is allowed to run to waste in the main channel.

Canals how originally constructed.

Most of these canals have been constructed by the people themselves at their own expense. A few again are the work of individuals; generally relatives or connexions of the ancient "Kutoch" Rajahs of the country. They all have distinctive appellations. One fine canal, which supplies water to four or five villages, is known as the "Daee-jee-ka-Kool," having been constructed at the charge of an old wet-nurse of Rajah Sunsar Chund. Another goes by the name of the "Dubhan" Kool, having been made by an old Rajah of that name. This canal, ever since the period of the Goorkha invasion (an epoch to which all disasters of the past are referred) had fallen into disuse. And last year, the people of their own free-will, with the assistance only of a Government chupprassy to collect the labourers, re-excavated the line at

their own cost; and restored the waters of irrigation to villages distant twelve miles from the canal head.

Kirpâl Chund's canal.

Another canal of great fame in this valley is one constructed about 150 years ago by Mean Kirpâl Chund, the brother of one of the ancient rulers of the hills. This canal, besides bearing the name of its founder, is emphatically styled by the people the "Dhurm Kool:" and, as its history is interesting, and the canal is one of the finest in the valley, I have selected it to illustrate the peculiar institutions in vogue for the maintenance and preservation of all these canals, and for the economy and distribution of the water.

The "Dhurm Kool" is taken from the river Niggool, just above the hill village of Bundla. There are four canals whose sources are above, and no less than sixteen canals rising below, the canal head of the "Dhurm Kool." Its length from its source to the point where its waters become exhausted is about twelve miles. The exact area it irrigates I have no means at present of ascertaining; but according to the local measurements it supplies water to two hundred and forty ploughs, each plough averaging about twelve acres, and paying in revenue of about fifty rupees. Thus the whole surface irrigated may be computed at 2,880 acres, yielding a yearly revenue of about 12,000 rupees.

The people bear the name of Kirpâl Chund in reverential memory. He appears to have been childless, and to have devised the construction of this canal as a means of perpetuating his name. His liberality to the people employed was munificent. To each labourer was given six seers of rice, half a seer of dâl, and the usual condiments; and to every pregnant woman employed, he gave an additional half allowance in consideration of the offspring in her womb. The people believe that he still exercises a fostering influence over his canal; and some time ago, when a landslip took place, and large boulders, which no human effort could remove, choked up the bed of the canal, the people one and all exclaimed that no one, but Kirpâl Chund could surmount the obstacles. They separated for the night, and the next morning when they assembled to work, the boulders had considerately removed themselves to the sides, and left the canal course clear and unencumbered!

The official at the embankment. His duties and perquisites.

At the canal head there is an officer stationed, who is the hereditary descendant of the man appointed by the founder. He has a water-mill, rent-free, close to the source; and his duty is to look after the em-

bankment, and make any little repairs which the passage of cattle, &c., may occasion.

Repairs of the canal.

During the height of the rains, the canal is usually closed. When the rains cease, and a fresh embankment becomes necessary, and extensive repairs are required along the canal course, the people are assembled, one from each house which benefits by the canal, and (marshalled by their respective "Koolees" or canal officers,) work in concert until the whole line is restored to a state of efficiency. In former days, any one refusing to contribute his aid to repair the canal was liable to fine by the village authorities; and now that this power is no longer exercised, it is sometimes necessary to lend the assistance of a thannah burkundauz, to collect the people and to set them at work upon the canal.

The village "Koolee" or canal officer.

The "Koolee" is an officer maintained by every village along the line of the canal to look after its particular branch. He is the guardian of the village rights, and sees that the due proportion of water, allotted by custom, for the village use, is fairly given. He patrols along the banks of his own branch, seeing that no water is surreptitiously withdrawn, and none allowed to run to waste. Any breach or damage in the banks, it is his duty to discover and immediately repair. He knows exactly the quantity of land in his village, and the proportion of water which each village is entitled to receive; and according to this scale, he distributes to each man in turn: and, any quarrel amongst themselves is referred to his arbitration and decision. By the old laws, if he succeeded in convicting any man of stealing the water, he was empowered to levy a fine of five rupees to be paid to Government, or to drag the culprit to the village "Koohee" or granary, (for the rents of the valley were formerly always taken in kind) and to place him in the stocks for a whole day exposed to the public gaze of the village.

Appointment of the "Koolee."

The office of the Koolee is not hereditary. On canals excavated by individuals, the descendant of the founder was allowed the privilege of nominating the "Koolee" on the occasion of a vacancy. On lines constructed by the people themselves, the village appointed its own man; and since our accession, the people have exercised this right on all canals, whether made by themselves or by independent parties. The "Koolee" is usually elected for life. His calling depends upon his honesty and strict impartiality; and he rarely abuses his trust. If he is unfair or unpopular, the people petition for his removal; and I adopt the rule usually observed with regard to other village

servants, and allow the majority to dismiss an obnoxious man, and to appoint a successor; but such cases very seldom occur.

The "Koolee" of the main canal.

Besides the "Koolee" for each branch, there is a "Koolee" for the main canal. His duties are the same in reference to the principal canal as those of the subordinate "Koolees" on their respective branches. He patrols along the main line, prevents theft, stops leakage, and looks after the general preservation and economy of the canal. The other "Koolees" acknowledge him as their chief: and not unfrequently he extends his beat to particular branches, and sees that the duties of his "subordinate agency" are properly discharged.

Emoluments.

On the ripening of the spring-crop, the "Koolee" proceeds to collect his dues. Unlike other village servants, who receive a portion from every harvest, his perquisites are limited to the spring; and he receives nothing whatever from the autumn or rain crop:—the reason probably being, that the autumn harvest is matured by rains from heaven, and is less dependent upon artificial irrigation.

Distribution.

He is entitled to receive from every plough of land, (*i. e.*, from every twelve acres of cultivation), twenty seers, local measure, of wheat; equivalent to about eight seers, according to the standard weight of India. On this canal, although each "Koolee" collects the dues leviable on his particular branch, he does not enjoy the whole proceeds. The collections, from each cut, are brought to a common fund, and on a given day all the canal officers, including the "Koolee" of the main line, meet at the head quarters of the canal, and make an equal and arbitrary division of the proceeds: the division not bearing any proportion whatever to the extent of a man's jurisdiction. The average receipts, by each "Koolee" on the Dhurm Kool, amount to about fifteen maunds of wheat a year, or six maunds pucka. The "Koolee" on the main line gets no more than his brethren. All share alike; and apparently they are well satisfied with present arrangements.

On other canals of less extent, there is usually only one "Koolee," who does all the work appertaining to the office; and of course receives all the perquisites.

Distribution of water.

Water appears generally so abundant, that there are no strict regulations regarding its distribution. On most canals, every man is helped in turn to as much water as ever he requires for the saturation of his fields; and probably his turn will recur and find him unmindful of the water at his disposal. On other canals, where the supply is not more than equal to the demand, some little economy is prac-

tised. A cultivator will look out anxiously for his turn, and perhaps be tempted to invade the rules. He will probably be limited to a certain quantity of water for a given extent of ground. The common proportion is a cut of eight fingers long, by three deep, for every plough of land. But this is the utmost attempt at limitation. There is no practice of restricting the number of irrigations; or of regulating the supply to the nature of the crop. Each man is entitled to a certain amount of water which he may take until the whole of his land is thoroughly saturated, after which his neighbour enjoys the same privilege in his turn.

By-and-by, when the settlement records come to be prepared, these unwritten laws must be reduced to record; and precautions taken to provide against that contingency (not far distant) when by the reclamation of new lands the demand for water shall equal and afterwards exceed the present supply. In such a time, a knowledge of the rules in force in less favored localities, such as Nuggeenah in Rohilcund and the Dehra Doon, will serve the district officer in good stead; and enable him through the agency of the village canal officers to introduce many useful reforms, and prevent much contention and fighting.

Mode of procedure on projecting a new canal.

In former days, when a new canal was projected by Government or any influential person, the direction was assumed without any heed to the individual inconvenience entailed. No one ever thought of listening to remonstrances: and the people quite understood the folly of preferring them. Every obstacle had to succumb to the public good: and the line would run through cultivated fields and farm-houses; and all parties would assent to the measure as a matter of course. The Government were expected to remit the revenue on lands taken up by the course of the canal, though they would not allow any compensation for loss of profits. They would also undertake to build another house in the place of the one they had summarily demolished. But they had no idea of postponing or abandoning a public work, because private rights were infringed, or any bold refractory Ryut ventured to oppose himself to the general weal.

In canals projected by the people, there were not likely to be objections. Such canals were the results of *bonâ fide* combinations for the general good; and the measure was sure to be thoroughly canvassed and understood before the line was settled. It was not likely that any cultivator, with the prospect of certain and luxuriant harvests, would refuse to contribute his labour, or demur to the abstraction of a little land. His scruples, if he were a sensible man, would be overcome in a village committee; but, if he was obstinate and deaf to all argument, the people petitioned the

Government, and the line was commenced without further delay.

With so many canals intersecting the country, the reader may require to know the arrangements in force when two canals meet. Such a contingency, notwithstanding the multitude of cuts, very rarely occurs; for every canal being destined for a specific village, runs on its course with scarcely any chance of encountering another; and it is only in the case of the longer canals, that lines cross. In such emergencies the people have a ready expedient in building rude aqueducts of long flat stones, which they lay across the lower canal and overlay the stones with clay. On the sides they build up a small embankment of clay, sufficient to retain the water in its rapid passage over the lower cut. Where they cannot get flat stones or slates, they use timber planks: and the water is crossed over without any loss or damage to either line. The country falls so rapidly, and is so undulating, that it is the easiest matter possible to keep one canal on a slightly higher level to the other, and thus to arrange their crossing.

Mode of crossing intersecting canals.

In this canal of Kirpâl Chund, notwithstanding its course of twelve miles, there is no attempt at regulating the levels by the construction of weirs or masonry falls. The canal, (and indeed all other canals) simply follows the level of the country in its gradual but rapid descent to the Beas: and the water comes tumbling along with all the noise and velocity of a mountain torrent. One would naturally expect that such a rapid current would soon convert its channel into a ravine; and undermine its way to a level so much below the surface of the country, as to render the water unavailable for the purposes of irrigation. But it is a strange enigma to me, to observe that the canal, although a century and a half have passed since its excavation, still keeps on the surface; and the people experience no inconvenience or difficulty whatever in taking the water. I believe the reason to be, the number of granite boulders thrown off from the lofty chain of hills to the north, which strew the valley in all directions, and of which the under-soil is principally composed. The canal flows, I may say, on a bed of boulders, leaping down one, to dash itself upon another; and by the intervention of these huge masses of rock, is prevented from cutting deep into the soil, as under other circumstances I presume it would.

No system of regulating levels.

I should mention, that the "Dhurm Kool" possesses the peculiar privilege of using clay with the stone in its embankment at the canal head. All other canals are

Peculiar privilege of "Dhurm Kool" in construction of embankment.

restricted to bare stones, through which, of course, a good deal of water escapes. The "Dhurm Kool" alone is allowed to use more tenacious material, and to construct an embankment nearly water-proof. This privilege is jealously insisted on: and I had lately to pay a visit to the canal heads, and to warn the others to use nothing, but the boulders in the river-bed, with a few green sticks to bind the mass together.

I have, &c.,

G. C. BARNES,

DEPUTY COMMISSIONER,

Kote Kangra, Trans-Sutlej States.

No. XXXVIII.

ESTABLISHMENT OF VERNACULAR LIBRARIES.

LETTER *No.* 24, *dated* "*Camp Boregaum,* 1*st February* 1849," *addressed by* LIEUT. H. L. EVANS, POLITICAL ASSISTANT IN NIMAR, *to* R. N. C. HAMILTON, ESQ., RESIDENT AT INDORE, *respecting the* ESTABLISHMENT OF NATIVE LIBRARIES IN NIMAR.

SIR,

With reference to the 21st paragraph of Mr. Secretary Allen's letter, No. 5085, dated 16th October last, requiring certain information regarding Native Libraries in Nimar, on receipt of which, the question of granting assistance towards them from Government, would be entertained, I have the honor to offer the following remarks.

2. The project of establishing Native Libraries originated with Captain French. It was his object to, as far as possible, promote the spread of education; and to this end nothing could tend more than the encouragement of a taste for reading, amongst those capable of doing so, that, by their example, others might be induced to learn: moreover, the taste for reading having been acquired or increased, the attention of the natives may, perhaps, then be turned towards works capable of affording instruction, and enlightening their minds. The geography and history of their own and other countries; works on practical husbandry, and mechanics; with many subjects on which the ignorance now prevailing is most intense and lamentable, it is to be hoped may be made known to them.

3. The sum of Rs. 1,397 was collected by voluntary contributions; of course induced by Captain French's persuasions and recommendations; and books, (of which a list accompanies), procured from Agra and Bombay. In the selection of the works, the people subscribing were entirely uninterfered with. A list was circulated of books obtainable, and from that they made their selection. It was judged unwise at first to attempt to influence their choice.

4. So far, then, people might be inclined to say that what has been done, was nothing in the right direction; that the great

majority in subscribing, had merely done so to please their local superior; and that the books procured, and perhaps once looked at, would be consigned to some corner and forgotten; and the whole regarded as merely a crotchet, useless and impracticable. But when I state that in three places,* the people have voluntarily, without a hint from myself, without in fact my being aware of it until done, come forward with a sum of money themselves, and requested some small assistance from Government towards building a place, where the books might be kept, and rear a reading room, or library: in fact, it must be conceded that an advance has taken place. They have also proposed monthly subscriptions, to which I have promised support.

5. In several places the inhabitants have without the assistance of a rupee from Government, built school-rooms; some in villages where schools did previously exist, but where there was no good place for them to meet in. In two instances, they have been built by the inhabitants, and a petition then sent in for an instructor to be appointed. This shows an appreciation of education.

6. A great dearth of books for the School is experienced; but that is giving way since the establishment of a lithographic press at Mundlaisur. In one School, where the inhabitants had built the room, and paid the teacher themselves, I found the only book to be a Hindee translation of the ten commandments, given them by a Native Missionary some six or eight months back.

7. It must be observed, that the native Libraries and Schools are entirely distinct. The latter are Government, the former, property of the people themselves. Any assistance towards them would be most thankfully received; perhaps best rendered by a present of books of the nature mentioned in my second paragraph: the simpler the better; and by permission to me, to assist them in building their reading rooms. The amount granted need be very small, and shall be specified, if his Honor the Lieut. Governor should be pleased to receive the request favorably.

8. I am conscious that much more might be advanced upon this subject than what I have stated, and that I have not done justice to it. It is impossible to too highly estimate the value of an increase of education. Not that perhaps very much is accomplised, by either the native Libraries or by the Vernacular Schools; but still something is done, and that may improve. With reference to the latter, (the Schools) I may mention that as a first step, the qualifications of the teachers have been attended to.

Having procured a very intelligent man from the Deccan, educated at the Poonah College, the several "*Pundyas*" (teachers) have been, and are being, in their turn sent in to Mundlaisur, and

* Burwai, Khundwa and Bahadurpore.

there, to a certain extent, taught their duty. Both in this, and in the preparing School books, Mr. Conlan, the Deputy Collector, has given great assistance.

I have, &c.,

H. L. EVANS,

POL. ASSISTANT,

In Nimar.

NIMAR POLITICAL AGENCY:
Camp Boregaum,
The 1st February, 1849.

MEMORANDUM OF BOOKS.

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3	3 0 0	Rookminee Seiwar, ...	9 0 0
2	7 0 0	Dhurmoshindo, ...	14 0 0
7	1 4 0	Nitea Curmosunggrah, ...	8 12 0
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15	0 4 0	Palliputtun Carika, ...	3 12 0
25	0 1 6	Soobadra Huron Aria, ...	2 5 0
5	0 0 9	Gunputhee Stotha, ...	0 3 9
5	0 0 9	Nuvograh Stotha, ...	0 3 9
10	0 0 9	Doorgrah Stotha, ...	0 7 6
25	0 0 9	Dunidro Hurun, ...	1 2 9
11	0 0 9	Ram Sthote, ...	0 8 3
11	0 4 0	Gelasoor Aucenn, ...	2 12 0
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20	0 2 0	Bhoopalia, ...	2 8 0
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10	0 1 6	Raj Eoz Owomoni, ...	0 15 0
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20	0 1 6	Soodama Churiter, ...	1 14 0
25	0 1 6	Rawn-gerowr, ...	2 5 6
25	0 1 6	Bulli Ancean, ...	2 5 6
5	0 1 6	Rammi Muntrache Solue, ...	0 7 6
5	0 1 6	Anju Mir Auccun, ...	0 7 6
11	0 3 0	Chucerovebhoo, ...	2 1 0
4	0 3 0	Sehorattri Mohuttumi, ...	0 12 0
11	0 3 0	Gujendro Ancean, ...	2 1 0
25	0 2 6	Ramgowro, ...	3 14 0
10	0 2 6	Palne, ...	1 9 0
10	0 3 0	Vencotesh Sthotra, ...	1 14 0
11	0 2 0	Marootijimnomo, ...	1 6 0
11	0 0 9	Gungas thotra, ...	0 8 3
10	0 1 0	Marooti thotra, ...	0 10 0
11	0 1 0	Bucasur Auccean, ...	0 11 0
11	0 1 0	Pardhim Auccean, ...	0 11 0
16	1 8 0	Marrati Buccur, 1st vol.	24 0 0
16	1 8 0	Marrati Buccar, 2nd vol.	24 0 0
25	0 12 0	Salapud hoti Goozratee, ...	18 12 0
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5	2 0 0	Marhati Coosuchi Poorwani, ...	10 0 0
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10	0	12	0	Subdosidhee Nibhunde, ...	7	8	0
25	0	2	6	Alsidheolkur, ...	3	14	6
50	0	0	6	Baloodkitha, ...	1	11	6
25	0	3	0	Bhoogul Veded, ...	4	11	0
25	2	8	0	Marhatee Nuksha, ...	62	8	0
25	0	4	0	Lipee Dhara, ...	6	4	0
25	0	4	0	Gibsun Sethki Procun, ...	6	4	0
16	0	10	0	Poorun Auk Gunnith, ...	10	0	0
10	0	12	0	A-poorun Auk Gunnith, ...	7	8	0
6	1	2	0	Bij Gunith, ...	6	12	0
15	0	3	0	Dhathooroo Pawslee, ...	0	15	0
15	0	2	6	Subdoroo Pawalee, ...	2	5	6
15	0	1	6	Somasschucro, ...	1	6	6
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21	0	3	0	Nithicutha, ...	3	15	0
40	1	8	0	Beital Punchisi, ...	60	0	0
25	0	8	0	Bhoegal Saur, ...	12	8	0
53	1	0	0	Subha Bilass, ...	53	0	0
8	0	6	0	Soodama Churitro, ...	3	0	0
14	0	6	0	Boogal Durpen, ...	5	4	0
9	0	3	0	Beda Aubhessakee Ful, ...	1	11	0
43	1	12	0	Singgasun Buttisi, ...	75	4	0
26	0	8	0	Vrinda Sathsai, ...	13	0	0
20	0	10	0	Madho Bilass, ...	12	8	0
7	3	0	0	Laichaundrica, ...	21	0	0
5	0	3	0	Sicsha Sunggrohu, ...	0	15	0
2	1	8	0	Cutha Saur, ...	3	0	0
1	1	4	0	Nuculiad, ...	1	4	0
4	1	8	0	Musnovi Mirhussein, ...	6	0	0
3	1	4	0	Binai Putrica, ...	3	12	0
1	10	0	0	Huree Wungsh, ...	10	0	0
1	3	8	0	Lilla Woti, ...	3	8	0
6	0	3	0	Stree-shicksa, ...	1	2	0
6	0	4	0	Opdesscutha, ...	1	8	0
10	0	3	0	Monorungun, ...	1	14	0
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37	0	3	0	Maptol, ...	6	15	0
				Total Rs, ..	1095	3	9

NIMAR AGENCY:
The 5th February, 1849.

E. E.

T. CONLAN,
Deputy Collector.

No. XXXIX.

SEASONING OF WOOD.

REPORT *to* H. B. RIDDELL, ESQ., C. S., POST MASTER GENERAL, N. W. P., *on the* ARTIFICIAL SEASONING OF BABOOL WOOD *for Carriage Wheels, &c., by* G. PATON, ESQ., POST MASTER, ALLYGURH, *dated 22nd October* 1849.

SIR,

I have the honor to report to you the result of my experience in seasoning Babool wood, by boiling it in water. I am aware that the process of boiling is not new as a mode of seasoning wood, but I believe it has been generally supposed that it is attended with a diminution of strength, elasticity, and durability, and as I have not found such to be the case, I am of opinion that a knowledge of the fact is of some consequence. When requested to undertake the superintendence of the Mail Cart Establishment on the Grand Trunk Road in 1842, I found great difficulty in procuring seasoned wood for wheels. Sissoo wood was very high in price, and so scarce that I could not procure it in sufficient quantity. I was therefore obliged to have recourse to Babool wood, and although plentiful, it was difficult to command a supply of any that had been seasoned by the common process of drying. This led me to have some fresh wood boiled and dried, and I was not a little surprized to find that the wheels, made of the wood by the usual process of seasoning by drying, were worn out, while those that were made of the wood seasoned by boiling were in an excellent state of preservation, although both had been subjected to the same or equal

degree of tear and wear. The experiment appeared at once conclusive, that boiling did not, as generally supposed, impair the strength, elasticity, and durability, at least of this species of wood; but on the contrary preserved and increased those qualities. Subsequent experience has tended to confirm this opinion, and I am inclined to account for the fact by the circumstance of *tannin* existing in, and abounding in, the bark of this wood. By boiling, the woody fibre is deprived of the fluid called the sap, while it is saturated or impregnated with the *tannin*.

The cohesion, and solidity or density of the wood, are increased, and the susceptibility to warp, split, swell or contract by the alternating exposure to heat and cold, dryness and moisture, is diminished by this mode of seasoning, and I attribute all these advantages over the common process of simply drying, to the amalgamation of the *tannin* with the woody fibre.

We have a well known instance of the action of *tannin* on the prepared skins of animals, which renders them, by uniting with gelatines, strong, tough and durable; or converts them into leather. Green wood answers best for boiling, evidently on account of the greater facility with which it parts with its sap or juices, and becomes impregnable with *tannin*. The bark should be more or less fresh, and boiled along with the wood. The length of time in boiling the wood should never exceed twelve hours, otherwise the strength, in place of being increased, might be impaired. After boiling, care should be taken to place the wood for some days under cover, and free from the chance of a current of air. The rainy and cold seasons are most favorable; and advantage should be taken of them.

The average time required for thorough seasoning by boiling, is only four months, whereas, by the slow process of seasoning by the natural action of the atmosphere, it is never less than from two to five years.

Independent then of the advantages already enumerated, we have also the important one of economy, to recommend the seasoning by boiling. To carry on the Mail Carriage, Truck and Waggon Establishment now attached to this Office, a large amount of capital would have to be expended, for the purpose of having in hand at all times a large supply of dry timber. This speedy process of seasoning is the means of saving the interest of the capital that otherwise would have to be employed. So much do I value *tannin* as a preservative of timber by boiling, that I would venture to throw out a suggestion of an experiment being made with it in our dockyards,

where dry-rot has of late been so destructive in our wooden walls. The oak, like the Babool, has its bark abounding with *tannin*, and if boiled together, the result might be equally important, in speedily seasoning without impairing the strength, and also of preserving it from the dry-rot. I have observed that the sap-wood or alburnum of the Babool, is, by boiling, rendered as good as the best wood, and the preservation of it I attribute to the *tannin*. The sap-wood, if left to the natural action of the atmosphere, would be found useless, as it would speedily become soft or friable, as if consumed by a species of insect or dry-rot. The exact nature of dry-rot is, I believe, still an open question, on which there is much diversity of opinion, but whether from the action of the seeds of cryptogamous plants vegetating in timber, the fermentation of the juices or albuminous parts, or from the consumption of the woody fibre by insects, I feel warranted in recommending the process of seasoning by boiling with *tannin* as a preservation of timber, from the simple observations of its effect in the sap-wood of the Babool tree. In what I have stated, my experience is entirely confirmed to the use of the Babool wood for wheels, for the composition of all the parts of which, viz. the nave, spokes, and fellies, it is equally well adapted. Those pieces are cut out in the rough state, then boiled, and laid out to dry; when thoroughly dried, the rough surface is taken off: and then they are cut of the exact size and shape required. The pieces for naves, before being boiled, are carefully turned according to the size required; after boiling, small holes for the spokes are cut: and then they are placed under cover to dry. When nearly dry (which usually happens under three months) any cracks that appear on the surface are carefully filled with paste or putty. They are then painted, and placed in the open air or sun. A second coat of paint is usually applied while they are exposed in the open air; after which they are considered fit for use, and the holes may at any time be enlarged to the size required for the spokes. The proper seasoning of the nave is important, as on it the strength of a wheel chiefly depends.

As a proof of the durability of the wheels, I may mention that the palankeen carriages and trucks, running at the average of 7 or 8 miles, in the hour, have passed over the distance of 114,660 miles; while the waggons, travelling at the rate of two miles in the hour, have passed over 50,652 miles.

The former have been in use about five, and the latter about three years and a half, with exposure at all times to the climate; and notwithstanding, the wheels are still quite serviceable. The wheels of the mail-carts, which run upwards of ten miles in the hour, have worn equally well; but I am unable to ascertain exactly

the distance over which they have passed. I give a decided preference to the straight or cylindrical wheel, as I am convinced that it is stronger and more durable than the wheel with much dishing. I think the result of the tear and wear of the wheel made here will bear a comparison with the wheels made of the best seasoned materials in any part of India or England.

I have, &c.,

G. PATON,

Post Master.

ALLYGURH POST OFFICE:
The 22nd October 1849.

No. XL.

CONSTRUCTION OF METALLED-ROADS AND BRIDGES, BY LOCAL COMMITTEES

EXTRACT *of a Letter from* LIEUT.-COL. A. H. E. BOILEAU, SUPERINTENDING ENGINEER, CENTRAL PROVINCES, *No.* 3562, *dated Allahabad,* 1*st March* 1849, *to the address of* J. MUIR, ESQ., C. S., *Secretary Local Committee, Azimgurh.*

PARA. 2. Mr. Martin is, I think, quite right in stating that the kunkur laid upon your roads has been imperfectly consolidated, and should have been well rammed when first laid down; for though considerable traffic of iron-bound cart wheels might improve the metalling in this respect, if the tires were not too narrow, yet the continual transit of irregularly-shaped wooden wheels (which are so soft that the points of the fragments of kunkur penetrate and disfigure them), causes mutual injury to the road and to the cart wheels; and destroys the metalling in a shorter time than would otherwise have happened.

3. I also agree with Mr. Martin in reprobating the pernicious practice of cutting deep ditches at the foot of the sloping sides of embanked roads, which, though saving a trifling part of the first cost of making a road, adds enormously to the subsequent expense

of maintaining it. After allowing a fair slope for the side of the road (not less than 1½ or 2 feet of base to each foot of perpendicular height,) a berm, or slip of level ground, should be left a few feet in width, according to the height of the embanked road, before any cutting is made for excavating soil to make that embankment.

4. The following extract from a statement of Lieut. D. Briggs' rates of executing various kinds of work on the great Deccan Road may be of use to your Committee.

EXTRACT.

Cost of cutting Jungul as executed in 1847.

Quantity of work done, ... 4,22,98,000 superficial feet.
Cost in Co.'s Rs., ... 3,686 10 8½.
Average per 1,000 superficial feet, 0 1 4⅝.
Average per man, ... 1,739 superficial feet; and the distance being 150 running miles cleared to a width of 52 feet, the rate per running mile is Rs. 24-9-3.

5. *Cost of lining and clearing Road.*

Quantity of work done, ... 1,05,39,620 superficial feet.
Cost in Co.'s Rs. .. .. 14,110 13 8.
Average per 1,000 superficial feet, 1 5 5.
Average per man nearly .. .. .. 135 superficial feet; and the distance being 133·076 running miles 15 feet wide, the cost per mile cleared was Rs. 106-0-7; or if divided among the whole 150 miles, the average would be Rs. 94-1-2.

6. *Cost of excavating Ghats, both for Hills and for Nullahs.*

Total, ... 24,48,551 cubic feet.
Cost in Co.'s Rs., ... 7,192 8 3.
Average per 100 cubic feet, .. 0 4 8½.
Average per man about .. .. 32 cubic feet, and Rs. 47-15-2½ per mile for 150 running miles.

The above rates apply to the difficult country lying between Seonee and Kamptee near Nagpoor, where even the plain earth-work required for the raising of roads costs about 5$\frac{1}{16}$ annas per 100 cubic feet, which is three or four times the rate of similar earth-work near Allahabad.

7. I have also the pleasure of subjoining for the use of your Committee various rates prevalent in the Allahabad Division, supplied by Captain J. Laughton, viz.

Pucka Masonry with 12-inch bricks of the commonest *Buharooa* lime, unplastered—

Foundation	@	8	1	3	per 100 cubic feet, and
Superstructure ..	@	8	5	6	per 100.

Plain Pucka Masonry roughly pointed @ Co.'s Rs. 8 13 6 per 100 cubic feet.

Superior Masonry with 12-inch bricks, and lime mortar of fine quality, unplastered—

Foundation	@	9	9	10	per 100 cubic feet, and
Superstructure ..	@	10	5	10	per 100.

Superior Pucka Masonry with 9-inch bricks unplastered—

Foundation	@	12	10	0	per 100 cubic feet, and
Superstructure ..	@	13	1	9	per 100.

Arch-work, with 12-inch bricks and fine lime mortar @ 11 0 7 per 100 cubic feet.

Inferior Lime Plaster ..	@	1	2	7	and
Superior Lime Plaster ..	@	1	9	4	per 100 superficial feet.

8. *Earthen Walling*, @ 0-8-0 per 100 cubic feet, or at 5 annas per 100, if water is close at hand.

Excavated Earth-work, for sinking a well 5 feet in diameter, and 39 feet deep at 0-4-5¼ per 100 cubic feet.

Earth-work for Roads, six inches high @ 0-1-0 per 100 superficial feet, brought from a distance of 20 feet.

Earth-work for Embankments, brought from a distance of 223 feet, rammed and dressed, but without turfing. Height of embankment about 30 feet, exterior slope 94 feet, surface width 28 feet;

Rate per 1,000 cubic feet Rs. 2-4-1, or Rs. 0-3-7·3 per 100 cubic feet.

9. I have further the pleasure of subjoining for the use of your Committee a table of the probable cost of bridges of various spans drawn up by Lieutenant D. Briggs.

Roadway 20 feet wide throughout.

Arches.	Span.	Height.	Masonry.	Probable Cost.		
	Feet.	*Feet.*	*Cubic feet.*	*Rs.*	*A.*	*P.*
1	2	2	316	36	2	8
1	4	2	618	72	3	7
1	4	4	661	77	1	3
1	6	3	558	63	9	8
1	6	4	439	78	6	5
1	8	2½	775	90	0	5
1	8	5	1562	178	10	10
1	10	5	1184	142	7	1
1	10	6	2288	261	14	3
1	12	5½	1830	204	1	6
1	12	8	2750	314	15	1
1	15	8	2807	309	7	10
1	15	10	4785	546	2	5
1	18	9	3659	401	7	9
1	18	9	4802	540	14	0
1	24	12	5942	690	10	8
1	24	12	8181	922	11	6
1	30	16	8827	1175	8	5
1	35	22	15176	2007	3	7

10. The above abstract was made after Lieutenant Briggs had begun to work upon my very economical principle of an Elliptical Tunnel* lying almost without any foundation upon very bad soil, but with its floor sunk a foot or more below the bed of the water-course, to guard against undermining by the current; which was further provided for by drop-curtains of masonry, such as would be called front and rear deep foundations in bridges of the ordinary construction.

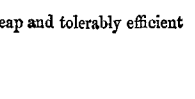
* See p. 70, No. XXIII. in Part VII. of the Selections.

11. The following is an abstract of Lieutenant Briggs' estimate for bridges of the common kind.

Arches.	Span.	Height.	Masonry.	Probable Cost.		
	Feet.	*Feet.*	*Cubic feet.*	*Rs.*	*A.*	*P.*
1	4	3	960	105	0	0
1	6	5	1792	196	0	0
1	6	7	2738	296	0	0
1	8	6	3261	352	0	0
1	8	7	5265	563	0	0
1	10	7	6037	640	0	0
1	12	8	8708	932	0	0
1	15	9	10187	1158	0	0
1	20	10	13608	1472	0	0
1	20	14	18272	1973	0	0
1	25	15	18357	1987	0	0
1	30	23	30113	3255	0	0
1	34	20	31031	3356	0	0

The tunnels in each of the above being 24 feet long, the parapets 2 feet thick, and roadway 20 feet wide.

12. I now purpose making a few general observations which may be of use to your Committee, as connected with road-making and bridge-building. The question of a levelling instrument has already been mooted in the correspondence with Major A. Knyvett, and though I think that Government would probably sell one to the Azimgurh Committee out of the Arsenal at Fort William, or from the Allahabad Magazine (if there is one,) yet the price would probably be about Rs. 250, and a simple instrument might be made as a substitute at a tenth of that cost. A tube of brass, lead or tin, about a yard long is to be bent up about 3 inches at each end, and a couple of Eau-de-Cologne flasks or medicine phials, with their bottoms cut off, are to be cemented one into each end of the pipe (as in the marginal figure,) so that when the pipe is filled with any colored fluid about as high as the middle of the glass phial, and the whole apparatus is stuck on a tripod-stand, it forms a cheap and tolerably efficient levelling instrument.



13. Where embankment-work was to be carried to a height of several feet above the plain, I have found it convenient to drive long stakes (or *bullees)* firmly into the ground in two rows, 30 feet asunder, (or whatever was to be the top-width of the intended road,) the stakes being about 50 feet asunder, and their heads exactly at the required level above the ground, so that they not only marked the alignment of the road, but showed the precise height to which the earth-work was to be raised. I also had lines cut in the ground to make the foot of the intended slope at each side, and another pair of lines to mark the width of the berm; not allowing any earth to be excavated from within those lines: in which manner the work cost fourteen annas per 1000 cubic feet, the embankment ranging from 1 to 5 or 6 feet in height.

14. Regarding the necessity for baling out the foundations of considerable bridges over large streams, it may be as well to mention that in constructing the iron suspension bridge of four or five openings over the Kalee Nuddee at Khoda Gunj, between Futtehgurh and Cawnpore, my brother Lieut. Colonel J. T. Boileau (now Superintending Engineer North Western Provinces) diverted the current to a considerable distance by an artificial cut and by embankments: thus raising his piers with little difficulty. An opposite plan was pursued at Indree on the Western Jumna Canal above Kurnaul, where a suspension bridge of 100 feet span was built on dry ground upon the isthmus, as it were, formed by a curved reach of the Canal; and when the bridge was finished, a cut was made under it; bringing the stream between its abutments; and the old channel was of course abandoned. Either of these plans may occasionally be found very advantageous to your Committee. And to make the Allahabad rates given in my 7th paragraph more complete, I may add that the price of well-burnt 12-inch bricks is Rs. 7½ per 1000; of fine stone lime 8 annas per maund; of best kunkur lime Rs. 22 per 100 maunds, of common kunkur lime Rs. 11 per 100, and of soorkhee 1 anna per maund.

No. XLI.

CONSTRUCTION OF WOODEN BRIDGES.

Letter No. 4903 *dated 5th October* 1849, *from* CAPTAIN E. W. S. SCOTT, SECRETARY MILITARY BOARD, *Fort William, to the* SUPERINTENDING ENGINEER, NORTH WESTERN PROVINCES, *respecting the proposed* BRIDGE OVER THE RIVER SURJOO AT BAGESHER IN KUMAON.

SIR,

With reference to the 2nd para. of your letter No. 4091 dated 26th April 1849, I am directed by the Military Board to annex a copy of Mr. Secretary Thornton's letter No. 694 with annexment on the subject of the proposed bridge over the Surjoo at Bagesher, and of the introduction of wooden bridges of large span in the Hills.

2. The Military Board request that your attention and that of the Executive Officers in the North Western Circle may be directed to the best modes of erecting such bridges.

3. There is a model in the Military Board Office of a light wooden bridge, upon a practical and economical principle, that appears to offer facilities for construction.

4. A plan* drawn from the model, and sufficiently correct to enable you to understand the principle upon which the bridge is put together, and of its details, is annexed.

5. A copy of the descriptive letter which accompanied the model is annexed.

* Vide Appendix.

6. The bridge may be briefly described to consist of planks, the side pieces being formed by vertical diagonals, fixed between two longitudinal planks, formed with bits above and below equally strong.

7. The lower longitudinal planked beams bear the sleepers of which the roadway rests.

8. The sleepers are notched over the planked longitudinal beams, and hold them at the same distance apart. The upper longitudinal planks support nothing except the tension in the diagonal side pieces; they give rigidity and strength to the whole structure, making the full depth of the side pieces or 7 feet (as the case may be) form one resistance to any side-stress which may tend to break the bridge. The diagonals between the upper and lower plank-beams act, in a measure, as the oblique rods of a tension bridge. The roadway is formed by a diagonal planked platform.

9. It depends upon the length of the bridge whether intermediate cross-binders are necessary.

10. When the span exceeds 20 to 30 feet, the length of the bridge is strengthened by a frame-work which binds together the several parts, and makes the structure firm.

11. The posts of this truss are let over the planked pieces, keying them apart and in upright positions; and a strong cross-beam under the road-way, supports the longitudinal planked side beams, and strengthens the connections between them and the upper beams, making the whole side piece firm and extending on either side, being braced to the tops of the posts by struts and iron bands. In a span of 60 feet two such keying braces are required.

12. The Military Board request that you will fully consider the above principle as applied to wooden bridges, and they authorize the construction of a model under your superintendence, in order that its strength may be tested.

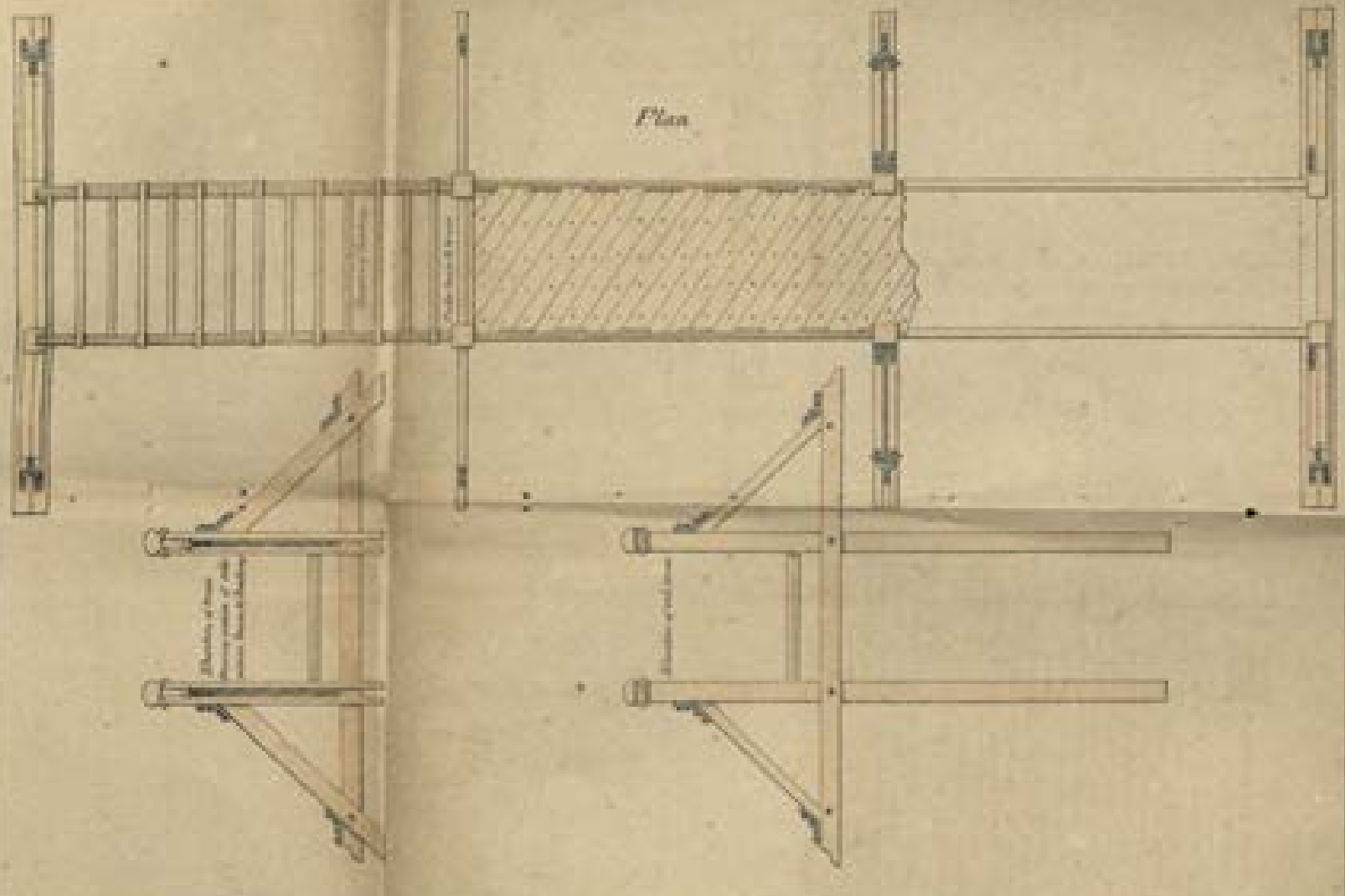
I have, &c.,

E. W. S. SCOTT,

Secretary.

MILITARY BOARD OFFICE,
5th October, 1849.

PLAN, ELEVATION
and SECTION of
A WOODEN LATTICE BRIDGE



Description of the Wooden Bridge referred to in the preceding letter, enclosed in a communication from Mr. H. Bigge, to the Secretary Military Board, Fort William, forwarding model of a Wooden Bridge built at Singapore.

The bridge from which the accompanying model is taken is one erected at Singapore, on the road leading to the north of the town across a small stream. The length of the span between the supports is 59 feet, the breadth 10 feet, height of sides 7 feet. The whole is constructed of planks, with the exception of two posts, at either end, and the sleepers on which the roadway platform is supported. The bridge was constructed by Captain Stevenson, M. N. I., Executive Officer, from a description of an American bridge of somewhat similar, but considerably more complicated nature (which was erected by an officer U. S. Army), consisting of 9 arches of 130 feet span each, and over which the turnpike road is carried on the lower level (or that of the bank of the river,) while the train-road of a railway is carried above, forming a double bridge of 1170 feet in length. The materials used by Captain Stevenson in constructing this novel, if not unique bridge, at Singapore, were slabs and other similar planks, &c., the refuse of the timber-yard, fastened together with wooden pins; iron-bolts with screw nuts being used where the diagonal planks meet the iron ones; one to each, so as to bring the frame together in the closest manner. Besides these no iron was used or other material than wood.

The planks used are 1 inch by 12 or nearly so, and, at the ends of the bridge, are received into the supporting posts cut out for that purpose, and then pinned together.

The horizontal planks when being placed, require that care should be had to prevent their being jointed at the same spot, or elsewhere than in the middle space, between two of the diagonals, when the joints being accurately fitted they are kept in their places by the pins. The sleepers are placed apart from each other 10 inches, the distance between the diagonal planks being 20 inches; such sleepers as are placed between the diagonals are notched, so as to allow of their ends overlapping the horizontal planks, and thus form binders to prevent the latter from bulging out on any great pressure being applied. Over these sleepers planks are nailed diagonally to form the roadway. The diagonal upright planks are pinned together at the point of contact, in the centre, as well as above and below. The roof is a light one of leaves, as generally used in the Straits.

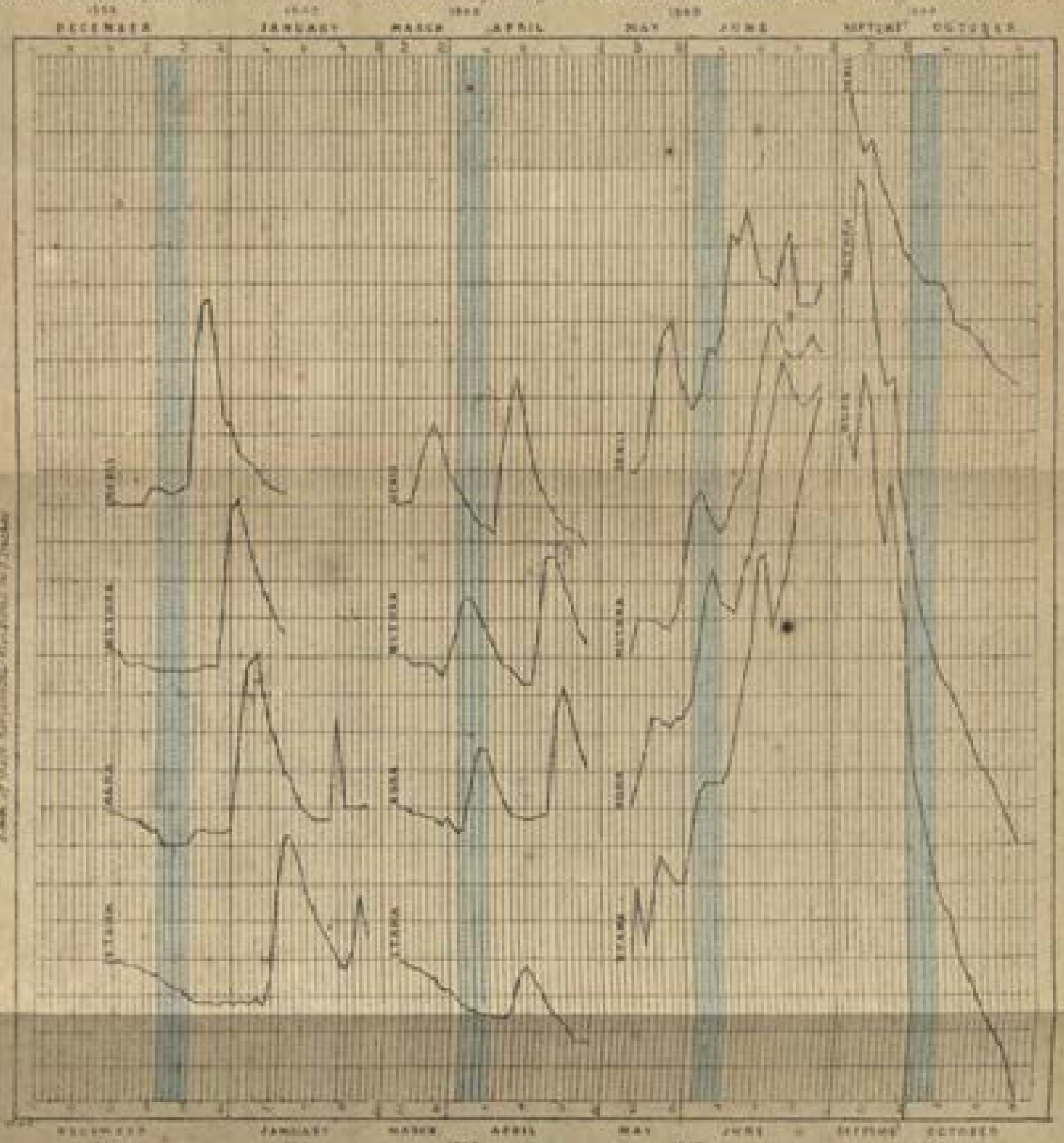
Mr. Thompson, Civil Engineer Singapore, told me he was prepared to construct bridges on this principle, 130 feet span for about Rs. 700 each.

The model is on a scale of 1 inch to a foot, and represents therefore a bridge 21 × 12. It has been proved with 276¾ lbs. placed on it, a trifle less than 2½ cwt., which caused it to yield equal to 3 inches, but the model received no injury. The expense of such a bridge of the very best materials at Moulmein is about Rs. 10 per running foot; one of the size of the model would cost Rs. 193-7-4, and requiring no greater degree of skill in erecting than that possessed by the most ordinary description of workmen; hence it is likely to prove useful in countries where wood abounds, as even should plank not be available, small trees, if care was taken in fitting them at the points of contact, would answer equally well. The traffic over the bridge at Singapore is very considerable. Buffaloes with heavy carts are continually passing and repassing all day, and had done so for two months ere I left, without damage to the bridge in the slightest degree.

The bridge is a temporary one built to keep open the road, whilst the pucka one is being rebuilt, and hence the use of inferior material to save expense; the cost I believe did not exceed Rs. 60 or 70.

H. BIGGE.

DIAGRAM Showing the effect upon the RIVER JUMNA of drawing the EASTERN and WESTERN JUMNA CANALS



NB. The dark lines denote the variations of the River Jumna — the working gauge being Zero, the rise or fall of the Water is represented from it.

The lower dark line represents the Water on which the Canals were filled to a depth of Eleven feet — the Depth equal to that gone.

Plan of the Jumna Canal

No. XLII.

THE JUMNA CANALS.

REPORT ON THE INFLUENCE OF THE JUMNA CANALS ON THE JUMNA RIVER; BY LIEUT.-COLONEL P. T. CAUTLEY, *Supdt. of Canals, N. W. P.*

Regarding the question as to the effect of the canals on the parent rivers, as navigable lines.

The question—"How far do the canals on the Jumna influence the capabilities of the river, as a navigable line? or, How far *will* the Ganges canal, now under construction affect the Ganges river?" has been frequently asked, frequently discussed, and with no better result, than the parties, who are most opposed to each other, remaining with their original views unaltered.

The only practical illustration on which arguments were grounded.

2. The only practical illustration of the Jumna canals not destroying the river as a navigable line, was shewn in cotton boats of a large tonnage reaching Agra, and boats of other descriptions arriving at a higher point of its course, and this too at a period when the canals carried away the whole of the observable supply of water which it received from the Himalayas. The argument for the Ganges was

founded on this fact, and in page 63 of my printed Report, the grounds for my opinion on the effect upon the Ganges, by the Ganges canal carrying off the whole of the observable Himalaya supply of that river, were given in detail. The argument was perfectly fair, and clearly philosophical. With natural phenomena corresponding, similar results were to be anticipated.

3. There remained, however, one process by which we might arrive at more precise conclusions; and this offered itself, in our ability to close the Jumna canals for certain fixed periods, and by throwing the whole of the water, that formed their supply, back into the parent river, discover, through the intervention of river gauges, the exact value of increment depending thereon.

Process by which more precise conclusion could be arrived at.

4. The Agra Government having warmly approved of the experiment, and directed no time to be lost in carrying it into effect, measures were taken, with the Superintendents of the eastern and western Jumna canals, to determine on periods of the year, when the test could be best applied, with reference to the object of the enquiry, and at the same time, cause as little interference as possible with the irrigation of crops and the interests of the farmers.

Measure sanctioned by Govt. N. W. P., and ordered to be carried out.

5. With the sanction of Government, the eastern and western Jumna Canals were stopped, and the supply of water thrown back to the Jumna, for four days, at four periods of the year, as follows:

Periods and places of experiments.

1st Quarter	on the	21st,	22nd, 23rd,	24th December 1848.
2nd Quarter	,,	1st,	2nd, 3rd,	4th April 1849.
3rd Quarter	,,	1st,	2nd, 3rd,	4th June 1849.
4th Quarter	,,	30th Sept.,	1st, 2nd,	3rd October 1849—

—'*Punsals*' or water-gauges having been carefully established, at the following points, on the river below them;

Delhi,	distant from	Canal Heads	147½ miles.
Muttra,	ditto	ditto	261½ ,,
Agra,	ditto	ditto	321½ ,,
Etawah,	ditto	ditto	451½ ,,

The registers were kept for a certain time previously to the above dates, and for a period, supposed to be sufficiently extended to admit of the full influence of the canal supply, afterwards.

The registers were to be taken three times a day during the periods noted, and rain-gauge reports, with any other necessary information, were to accompany the returns.

Records kept.

6. With exception to the registers from Agra and Delhie, which are imperfect, (the former in the 2nd and 3rd, and the latter in the 1st Quarter,) and also from the total absence of that from Etawah during the 4th Quarter, arising from the river-gauge having been washed away, the records, the whole of which accompany this paper, were satisfactorily kept. I find, however, that, *firstly*, sufficient time was not given at Etawah for the effects of the rise of the river being shewn, as exhibited in the 2nd Quarter, when the Register terminates precisely at the period when the excess of water was coming into operation; and *secondly*, that no results can be derived from the triple daily measurements. My observations are therefore confined solely to the recorded height of water at 6 A. M. daily.

Note on the 1st Quarter.

7. A fall of rain in the upper parts of the Jumna valley as well as at Agra and Muttra, previously to the commencement of the observations for December 1848, is exhibited on the diagram by a defined though slight rise of the river at Delhi, Agra and Muttra, more indistinctly marked at the Etawah river-gauge. The usual cold-weather rains however had not fallen, so as to offer any interruption; so that the diagrams, exhibited on the 1st Quarter of the Table, may be accepted as a very fair test of the experiment.

Dates of closing and opening the canals.

8. The canals were closed and the whole of the water was turned into the main Jumna, at 7 A. M. on the morning of the 21st. On the evening of the 24th December, the river was deprived of this supply, the water having pushed down the main river for four full days.

Effects on the Jumna.

9. The effect of this additional supply upon the river, appears to have been as follows:—

In 5 days the Jumna commenced rising on the Delhi Punsal.

" 9 " " " " " " " Muttra "

" 11 " " " " " " " Agra "

" 15 " " " " " " " Etawah "

The gradual rise being distributed at each water-gauge amongst four days, excepting at Etawah, where the rise continued for a fifth day.

The total rise, on each water-gauge is—

At Delhi, ..	15½ inches.	At Agra, ..	13¾ inches.
„ Muttra, ..	13¼ „	„ Etawah,..	14 „

The rate of progress from

Heads to Delhi, ...	29·5 miles	per day.	
Delhi to Muttra,.....	28·5 „	„	„
Muttra to Agra,.....	30·0 „	„	„
Agra to Etawah, ...	32·5 „	„	„

or averaging on the whole distance of 451½ miles, an advance of 30·1 miles per day, or 1·85 feet per second of time; equal to 1·254 miles per hour, a rate which, with a section of river like that of the Jumna at this period of the year, may be considered a fair average approximation.

10. The decline of the river's height, after the maximum point had been gained, appears, in every case, to have been more gradual than the rise, and on the fourth day from the commencement of the decline, the height of the river was considerably in excess to that four days previously to the commencement. In fact the surface of the river, at this period, appears to have been permanently affected by other causes than the canal supply, as it continued on a higher level than it was when the canals were closed. It will be observed by the diagram* that at the period when the observations commenced, the Jumna was lower than usual, and the result of the experiment was, in all probability, more conspicuously shewn.

11. The river was affected by rain, or some other cause, previously to the canals being shut; this is very distinctly shewn by the diagram. This affection to the curve is exhibited throughout the whole series of Delhi, Muttra, Agra, and Etawah, and it gives us another element for determining the progress of the flood water. The effect upon the Jumna, by the shutting of the canal, is unfortunately, not shewn at Etawah; the observations having ceased previously.

Note on the 2nd Quarter.

12. In this diagram, however, we have two distinct and well-defined series of curves; the first arising from extraneous causes; the latter from the experiment in progress. In each case there is a remarkable coincidence in the progression of flood as shown by the high-water marks; a coincidence common to both the 1st and the 2nd Quarter.

* Vide Appendix.

		Delhi.	Muttra.	Agra.	Etawah.
1st Quarter.....	Canal flood,	1	5	7	11 & 12
2nd Quarter.	Ditto,	1	5 & 6	7	0
	Extra flood,	1	5 & 6	7	13

The total rise, in this Quarter was,

At Delhi, .. $12\frac{1}{2}$ inches.
„ Muttra, .. $10\frac{1}{2}$ „
„ Agra, .. $10\frac{1}{2}$ „

The gradual rise to the Jumna being effected in four days at Delhi, and in only three days at Muttra and Agra; the decline appears to be less rapid than the rise, but the effect upon the surface of the river is a sensible one.

Note on the 3rd Quarter.

13. The Jumna river was gradually rising at the period when the canal was closed; whatever effect the canal supply may have had upon the river, it is not shewn in the diagram; the curve being on the ascendant and continuing, with little variation, on the ascendant throughout.

Note on the 4th Quarter.

14. Here the canal supply has no effect upon the surface of the Jumna river which is rapidly on the descendant.

Deductions.

15. From the above observations, and from the curves of the diagrams which accompany these, I draw the following conclusions.

1st. That the higher the water is in the Jumna, the less is the surface of the river affected by the water taken away from it by the canals.

2ndly. That the canals only affect the surface of the Jumna river when that river is low, *i. e.* during the cold, and the early part of the hot weather; especially in the early part of March.

3rdly. That the maximum affection occurs in the latter part of the cold weather, and in the early part of March; and that the rise of surface, noted in the diagram of the 1st Quarter, of from $15\frac{1}{4}$ to $13\frac{1}{2}$ inches, in December and January 1848-49, may be considered a fair maximum effect upon the river, during those months.

Were boats sticking upon a sandbank, or on the top of a rapid, the above rise of surface would, in all probability, relieve them; but it is questionable whether, using the term "navigable river" as usually applied, the Jumna (considering the wide expanse of its

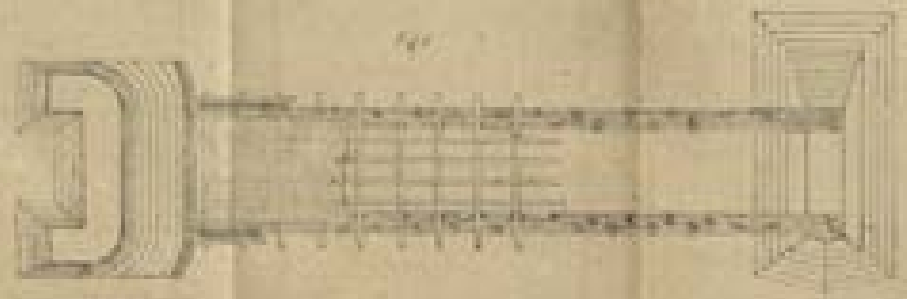
bed, and the numerous shoals that distinguish its course, from the Himalayas to its junction with the Chumbul below Agra) would, with the additional rise of surface above noted, be more favorably open to navigation than it is at present.

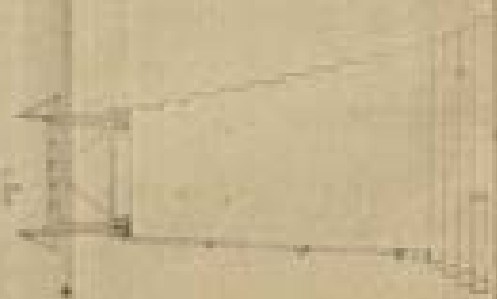
16. At any rate the above observations confirm the assertions that have been made before, that the subtraction of a supply for the canals only affects the Jumna river during three months in the year, that is, from the middle of December to the middle of March; at which latter period the melting of the snow in the mountains has a visible effect upon the river.

P. T. CAUTLEY, LIEUT.-COL.,

Supt. Canals, N. W. P.

DESIGN for a Timber LATTICE BRIDGE over the Bermuda River — JUBULPOOR





No. XLIII.

DESIGN *for a* BRIDGE *over the* NURBUDDA RIVER *near* JHUBBULPOOR; *by* LIEUT. DAVID BRIGGS; *Surveyor, Jhubbulpoor and Kamptee Road.*

SPECIFICATION, *for the construction of a* TIMBER BRIDGE, *with stone piers and abutments, across the river* NURBUDDA, *at* GAWARIE GHAT, $3\frac{3}{4}$ *miles distant from the station of* JHUBBULPOOR, *on the* GREAT DECCAN ROAD.

1. LENGTH OF BRIDGE.—The bridge will be 970 feet in length, divided into ten bays; the distance between the centres of the piers being 97 feet.

2. ABUTMENTS.—The south abutment shall be built 15 feet, horizontally, and 12 feet vertically, into the bank, which is composed of very stiff clay. It shall be built in steps towards the rear, so as to give it a batter of 6 inches in 18, until it has acquired the requisite breadth of 15 feet; below which the foundation will be carried down 12 feet, at an angle of 35°, built in steps of 12 inches wide and 18 deep, as shown in Fig. 3. The north abutment will be sunk into the bank 15 feet vertically, with a base of 14 feet, protected in the rear by four steps of 18 inches in breadth, and 3′ 9″ in depth. The face will also be secured by four steps of one foot each.

3. PIERS.—The foundation of each pier, shall be sunk until it rests either on rock, or such hard compact soil, as to place any chance of shifting out of the question. The masonry shall be laid in courses of two feet in thickness, decreasing in steps of 12 inches wide and 18 high, towards the level of bed of river. The

piers shall be 40 feet high, 10 feet wide at foot, and four feet at top; 28½ feet long at bottom and 17 feet at top; having the up-stream face protected by the blocks of stone, composing the column, being laid so as to form a cut-water projecting one foot.

The down-stream face will be built in ten steps, one foot wide and four feet deep, (*vide* Fig. 2,) so as to form a buttress offering the greatest resistance to the volume of water rushing down on the pier, as also affording an easy means of ascending or descending to any part of the piers that may require repair.

4. MATERIAL.—The whole masonry used will consist of blocks of dressed sandstone laid in regular courses; the mortar of stone-lime mixed with river sand, in the proportion of two measures of the former to five of the latter.

5. The principle on which the superstructure of the bridge will be constructed is that entitled the "double truss" invented in 1835 by Ithiel Town, an American Engineer, and that it may be understood how much it is practised, and how well it answers, I have in Appendix A, given a quotation from Mr. Weale's work on bridges, which mentions a few of the instances where the principle has been successfully adopted in crossing rivers of great size. I may here mention that the bridge herein specified shall be of sufficient strength to bear the weight of an engine, and train of loaded carriages.

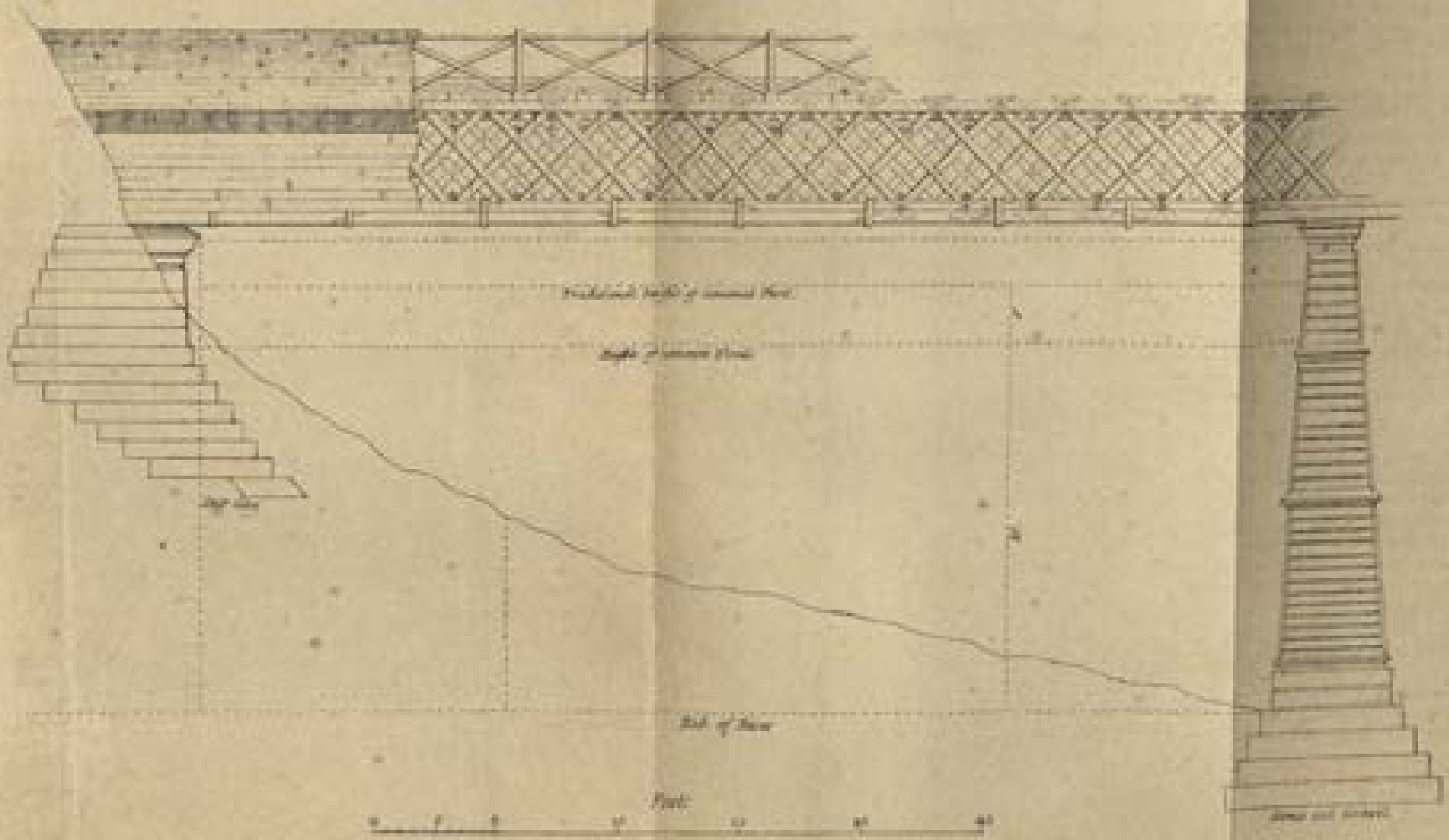
6. The bridge will be constructed of a double truss on each side of the roadway as shown in Fig. 3. Each truss will consist of a series of diagonal braces 10″ by 3″ inclined at an angle of 47° crossed by another series inclined at the same angle in an opposite direction, and of a horizontal string-piece 12″ by 3½″ on each side, at top, and bottom; the whole being firmly secured by trenails of babool wood 1¼ inches in diameter.

The height of the truss will be 9 feet; being little less than one-tenth of the distance between the piers. Each double truss will be further strengthened at foot by three wall-plates, each 14″ by 9″ pinned into the truss frames, and the whole secured by iron straps 2″ by ¼″ passing round both wall plates, and string pieces at every ten feet. Fig. 2 shows the way in which the double trusses will be put together with string-pieces between them, and the wall-plates at foot; and Fig. 1 gives a horizontal section, showing how the trenails connect each string-piece and truss.

At every five feet, tie-beams 9″ by 9″ will connect the lower part of the double truss frames with each other; and at every 5 feet on the top of the frames at C.C.C. (erroneously shown in Fig. 3, as on the top of the crossing of the truss braces at *d,d,d,*) floor beams 9″ by 9″ shall be placed, connecting the truss frames together at top. Every second floor beam shall extend 3 feet beyond the verge of the road-way, to receive the strutts of the railing stanchions at right angles to the floor beams; and pinned into

LATTICE BRIDGE

Fig. 3



them will be laid road-way beams 7″ by 7″ at every 3 feet. The flooring will consist of 3 inch planks extending across the whole surface of the platform, and two skirting boards, 5 inches high, and 2 inches thick will be set up along the edge of the planking, to confine the road metal which will be laid on 5 inches thick.

The railing will be 5 feet high with stanchions 5″ by 5″ let into the floor beams and propped up by stout strutts at every 10 feet. The stanchions shall be connected together, by a top and two diagonal braces, of a scantling of 4″ by 3″.

7.* APPROACHES.—In the estimate I have allowed 15 feet of wood-work on either side for the approaches to the bridge, which however will scarcely be necessary, as they will be cut out of the solid stiff clay.

8. DESCRIPTION OF WOOD USED.—All the wood required for beams, wall-plates, truss braces, &c. shall consist of well seasoned teak, and the whole of the wood used in the bridge will be steeped in a solution of corrosive sublimate for the space of 7 days.† All the wood used in this bridge will be cut up on the spot by a saw-mill driven by water, of a very cheap and simple construction; a description and plan of which are given in Appendix B.

D. BRIGGS, LIEUT.,

Surveyor, Jhubbulpoor

and Kamptee Road.

---

* *Note.*—I had at first intended to enclose the whole wood-work of the bridge by a covering of plank, as represented in Fig. 3, but as the expense would be very heavy (about Rs. 11,000,) and I believe incommensurate to the advantages gained, I shall omit any mention of it in this specification.

† *Note.*—I have been deterred from making provision in this specification for either painting, or paying with dammer, the wood-work of the bridge, by the written testimony of so many experienced Officers of the Engineer Department, both in this country and in England, which goes to prove "that "painting or paying is one of the greatest causes of decay in timber, as it "completely prevents the air from acting on the wood," thereby keeping all moisture within, which of itself is sufficient to decay it.—*Professional Papers of the Royal Engineers, vol. v., page* 282.

ESTIMATE, framed by Lieut. David Briggs, of the probable expense that would be incurred in building a Bridge, of ten bays, on the "double truss" principle, across the River Nurbudda at Gawarie Ghat, near Jhubbulpoor, on the Great Deccan Road; according to the foregoing specification and accompanying plan.

Agra, 29th March, 1850.

No.	DESCRIPTION.	COMPANY'S RUPEES. Rs. As. P.	Rs. As. P.
8877724	Cubic feet of masonry in abutments and piers at Co.'s Rs, 14-0-0 per 100 cubic feet, ..	12428 13 3	
6000	Rg. ft. of teak timbers 14" by 9" at 0-2-0 per foot,	750 0 0	
2000	Rg. ft. of teak string-pieces 12" by 3½" at 0-1-6 do.,	750 0 0	
1600	Trusses 14½' by 10' by 3" at 0-12-0 each, ..	1200 0 0	
206	Tie-beams 18' by 9" by 9" at 1-0-0 each, ..	206 0 0	
266	Floor beams 22' by 9" by 9" at 1-4-0 each, ..	257 8 0	
6000	Rg. ft. sleepers 7" by 7½ at 0-1-0 per foot, ..	375 0 0	
412	Braces 16' by 5" by 5" at 0-10-0 each, ..	257 8 0	
210	Iron straps(screws included)9' by 2" by ½" at 2-0-0 ea.	420 0 0	
15916	Supl. ft. of 3" planking 15'.10" wide at 0-3-0 per supl. foot, ...	2984 4 0	
2000	Rg. ft. of skirting boards 5" by 2" at 0-1-0 per foot,	125 0 0	
2000	Rg. ft. of rails 5' high with stanchions 5" by 5" at every 10 feet at 0-8-0 per foot, ...	1000 0 0	
15916	Supl. ft. of road metal at 1-8-0 per 100 supl. feet, ..	238 11 10	
	Trenails and iron work not included in the above,	1500 0 0	
	"Kyanising" the whole of the wood-work, ..	1000 0 0	
			23492 13 1
	Total Co.'s Rs....		23492 13 1
	Total Contingencies, at 5 per cent.,....		1124 10 3
	Total Co.'s Rs.,....		24617 7 4

This includes the fitting and setting-up of all the wood-work.

D. BRIGGS, LIEUT.,

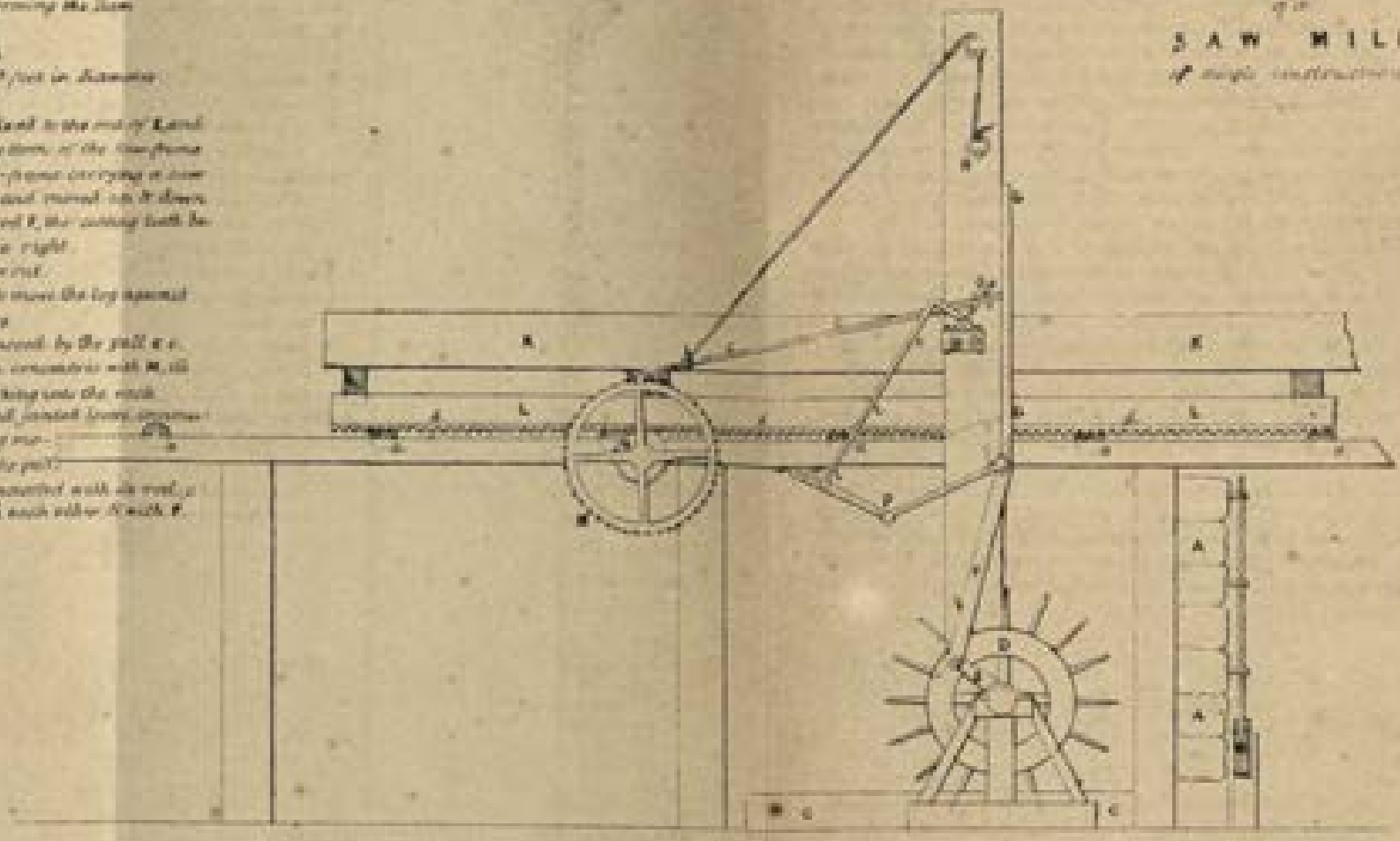
Surveyor, Jhubbulpoor

and Kamptee Road.

SKETCH
of a
SAW MILL
of simple construction

REFERENCES.

A A. Sleeper forming the frame
B Sluice
C C. Trough
D Wheel & fixed in Masonry
E Crank
F A rod placed in the end of Lever
to the bottom of the Gate frame
G G. The door-frame sliding in grooves
of posts and raised with & down
by the rod F, the passage both being
to the right
H. Leg to the rest
L. Fingers to move the leg against
the saw
M Wheel moved by the pitch & c.
N A pinion communicates with M, its
teeth working into the rods
O P Rod and jointed lever communi-
cating mo-
tion to the pit
Rollers connected with the rod, c
and with each other N with P.



Scale of Feet

0 1 2 3 4 5 6 7 8 9 10 11 12

D. Bridges Lieutenant
Commanding Officer
Royal Devon Regt.

Printed at the Inniskillen Dispatch Office

APPENDIX A.

DOUBLE TRUSS BRIDGES.

The following is quoted from the description given of the "double truss" bridges in Mr. Weale's work.

"In America there are already many of these bridges on a "scale of magnitude truly gigantic; among the most important of "these is the one erected by the celebrated Engineer, Moncure "Robinson, Esquire, for carrying the Richmond and Petersburgh "Railway across the falls of James' River at Richmond. The "length of this bridge across the river is 2,900 feet, and the "trusses are supported on eighteen granite pillars, the distances "between the piers varying from 130 to 153 feet. The piers are "founded on the granite rock over which the rapids flow. Their "height above the surface of the water is 40 feet, and they are "carried up with a batter of 1 inch in 2 feet vertical, up to this "height of 40 feet above the water, where their dimensions at top "are 4 feet in breadth by 18 in length. The floor in this "bridge is on the top of the truss frames, and the depth of "these being 20 feet, the road way is carried horizontally across "the River, at an elevation of 60 feet above the water. This "bridge was completed in September, and its cost was about "£24,200 sterling. In addition to this great work on Mr. "Town's principle, executed by Mr. Moncure Robinson, may be "mentioned another on the same principle across the Susquehan-"nah, 2,200 feet in length with spans of 220 feet; besides several "others. These bridges may be constructed of any kind of "timber, however soft, provided planks of about 27 feet in length "can be sawed out of it: while pine, spruce, and poplar, have been "extensively used in America; but oak is objected to, on account "of its tendency to spring or warp, if not well seasoned."

APPENDIX B.

VERTICAL SAW-MILL.

The annexed sketch of a cheap and simple vertical saw-mill, in common use in America, will show the means I intend employing in cutting up the large quantity of timber I shall require in the construction of the work above treated of. The following references to the sketch will make the whole construction perfectly clear. A, the

dam, formed of squared logs resting against a standard 12" by 12," strutted from the rear; the dam being filled to the requisite height by a bed from the Nurbudda: provision being made to carry off the surplus water. B, is the sluice, 5 feet broad, 18 inches high, and 4 inches thick; which, when it is wanted to work the saws, is raised, and admits the water into the trough, C, to the wheel D, whose outer diameter is only 5 feet, in order that the velocity of the water may give it as many revolutions as possible, consistent with the necessary power, and thus enable the saws to make as many strokes as the wheel makes revolutions. The length of the wheel is 5 feet. E, a crank on the wheel-shaft, to which is fixed the connecting rod F, (which is fixed to the bottom of the saw-frame G,) which, carrying the saw or saws, runs up and down between the standards, having an alternating motion communicated to it, to the extent of the double length of the crank-arm. E, K, is the log to be cut. It is mounted on the frame L. which has a rack *d, d,* fixed upon its under surface, and which is supported by the rollers *a, a, a, a.* The pinion N, on the axis of the wheel M, works in the rack; and, according as the wheel moves forward and backward works the frame towards or away from the saws. Motion is communicated to the wheel by the pall *c, c,* (which may be lifted out of gear, when necessary, by the rope and ring H), and the other end of which is pinned into one of the holes in the arm of the bent lever O. This lever is moved backwards and forwards by the rod *e, e,* which is jointed to the bent-rod P, fastened at one end to the frame of the building, and at the other to the frame carrying the saws. In this mill I intend using three saws at once. Almost all the parts which in this sketch are shown as of iron, may be made of hard wood; and I believe that the mill may be set agoing for about 400 Rs. At a very moderate calculation, it may, with the assistance of two coolies, saw up 2,000 running feet of timber per diem.

D. BRIGGS, LIEUT.,

Surveyor, Jhubbulpoor

and Kamptee Road.

No. XLIV.

DURABILITY OF TIMBER USED IN FORMING BRIDGES.

I.—EXTRACT (PARAGRAPHS 83, 84 AND 85) OF A DESPATCH FROM THE HONORABLE THE COURT OF DIRECTORS, DATED 15TH FEBRUARY 1850, *enquiring with reference to the construction of two Bridges, between Bareilly and Budaon, what precautions had been taken to protect the timber from white ants and dry rot.*

PARA: 83. "These bridges are to be constructed partly of timber; the object of the Committee of the Bareilly Road Fund being to open communications throughout the District as quickly as possible, which, from the cheapness and abundance of timber, they expect to accomplish within three years.

84. "The practice of forming bridges composed partly of timber, has in some cases, as appears from the letter of the Secretary of the Local Committee, dated 20th February 1847, effected a saving of three-fourths in the cost of their construction as compared with masonry bridges, and they are found fully equal to the heaviest traffic.

85. "This is satisfactory; but we should wish to be informed what method has been adopted in order to protect the timber from the ravages of the white ant and dry rot."

II.—REPORT, *dated, 3d May,* 1850, *addressed to* GOVERNMENT, N. W. P., BY HENRY PIDCOCK, ESQUIRE, C. S., *Commissioner of the Rohilcund Division.*

SIR,

Having circulated to the Vice-President of the several Road Fund Committees of this Division, the Extract, paras: 83 to 85 of a Despatch from the Honorable the Court of Directors, received with your letter No. 447, dated 15th February last, I have now the honor to transmit their replies.

2. It will be observed that numerous bridges, partly of masonry and partly of timber, have been constructed in this Division, and that although no precautions have been taken, in order to protect the timber from the ravages of the white ant and dry rot, beyond the common application of rosin, arsenic and oil, it does not appear to have sustained any injury.

3. Most of these bridges have been recently constructed. There are, however, two referred to by the Shahjehanpoor Committee as having existed for very long periods without any apparent injury to their timbers; one from 1747 A. D., the other from 1819.

4. White ants will not, I believe, attack any substance that is not in a state of repose, and the security of the timber in the bridges referred to, is, I have no doubt, mainly to be attributed to the vibratory motion communicated to it by the constant use of the bridge. Of course, none but the hardest and darkest colored portion of the timber, is employed in the construction of such bridges.

I have, &c.,

HENRY PIDCOCK,

Commissioner.

BAREILLY, *3rd May,* 1850.

III.—LETTER, *dated 15th April*, 1850, *from* J. R. BARNES, ESQUIRE, C. S., *Secretary to the Road Fund Committee of the Shahjehanpoor District, to* H. PIDCOCK, ESQUIRE, C. S., *Commissioner of the Rohilcund Division.*

SIR,

In reply to your Circular, No. 9, dated the 16th February last, forwarding copy of a letter from Government, with copy of its enclosure, the Committee would beg to state that no provision has been made to protect the timbers used in their bridges from either the ravages of the white ants or the effects of the dry rot, beyond what is commonly applied, viz., a composition of rosin, arsenic and oil, boiled together.*

2. At the same time, they would remark, that there are many bridges, within the immediate vicinity of this city, built on this principle, viz., of combination of masonry and timber, which, though they have been built for many years, have yet, as far as the eye can judge, their timbers quite sound and entire: for example,—

I. A small bridge, combining masonry and timber in the Kukra mohulla, near to the Mudra Khel Chokey, said to have been built by Akhoon Moolla Jubbar Khan, in the year 1747.

II. The large bridge over the Khunout, built by Hukeem Mehdee in the year 1819. In this, the timbers have been proved quite sound, when during the last year, the shape of the centre arch was lessened.

III. Those belonging to the old Lodhipoor bridge, when broken up in the year 1846. Besides these, there are in the district many others.

3. Facts proving, perhaps, that protection is afforded to these timbers, from the ravages of the white ants, by the vibration caused by the passage of wheeled conveyances, &c. Of the effects of the dry rot, but little fear need be entertained; provided a careful selection of the timber is made, and all those, in which the slightest appearance of a white vein is visible be discarded.

I have, &c.,

J. R. BARNES,

Secretary.

Shahjehanpore Road Fund Committee Office:
15th April, 1850.

* In the proportion of rosin 1 seer, arsenic 2 chittacks, and oil 1 seer.

No. XLV.

BRICK-MAKING MACHINES AT ROORKEE.

I.—Memoranda *on* Hall's *and* Ainslie's Brick-making Machines, *as used in the* Roorkee Brick Fields, *by Lieut.-Colonel* P. T. Cautley, *Director Ganges Canal Works.*

The masonry works on the Ganges Canal in the immediate neighbourhood of Roorkee, a town situated 23 miles E. S. E. of the town of Saharunpoor, required for their completion, in round numbers, 1000 lakhs of bricks, measuring 12″ by 6″ by 2½″; the period fixed for the completion of these works was six years: a quantity of bricks therefore equal to 166 or 170 lakhs was required annually.

2. Without entering into a detailed statement of the arrangements made for the manufacture of so much material, the collection of so much fuel, or the concentration of such large bodies of laborers at a point near the Sewalik forests, and in a country whose inhabitants are chiefly agricultural, it may be sufficient, with reference to the heading of this memorandum, to draw attention to the mere difficulty of procuring, in sufficient abundance, *brick-moulders*, or men to make and mould the bricks, previously to their being placed in the kilns.

3. The brick-making season is from the 1st October to the 15th of June, and (deducting Sundays and rainy days) two-hundred days in each year may be considered a maximum working period. Supposing, therefore, that each brick-moulder made 800 bricks per day, one hundred and five men per day would be required to make the number of bricks required for the Roorkee works.

4. To collect so many brick-moulders, and maintain them constantly at work, considering that their services were not required for three and a half months in the year, was a matter of very serious difficulty. To be utterly dependent, on a class of people, moreover, who absented themselves whenever it suited their convenience, and, who, knowing how dependent we were on their services, took advantage of their ability to cause interruption by repeated *strikes*, was an evil of very great magnitude; it was an evil in fact that machinery alone could get rid of.

5. During my visit to England in 1846-47, my attention was constantly directed to this point. The tile machine, invented by the Marquis of Tweedale, and other apparatus both for tile and brick-making, were fully appreciated in Europe. Mosul Bey, the French Engineer on the Barage on the Nile, where three brick-machines were at work, had shewn me bricks made by this machinery. The question for me to determine was, the applicability, or not, of machinery of the sort above alluded to, to our works situated at a great distance from a foundry, and at that time from all practical mechanical aid. In all my enquiries in England, I was universally referred to Ainslie's brick and tile machinery. It appears to be in common use, and is exceedingly simple both in principle and construction. In the manufacture of either bricks or tiles, the clay, which has been properly prepared and tempered, is passed through iron rollers, and from these through upright moulds of the form that the brick or tile is to be made. The moulded clay as it then comes out of the latter is cut off by wires into the lengths required. This machine is made of cast iron, with iron spur-wheels, the breakage of which in the upper provinces of India would lead to inconvenience. Its simplicity appears to have recommended it to the English brick-makers, but the chance of breakage, and the difficulty of replacing cast iron wheels at a distance from a foundry, were in some measure opposed to its success at a remote province in northern India.

6. As the apparatus however had stood the ordeal of much use in England, and was highly recommended, I thought it advisable, to ensure progress, to direct two of these machines to be sent to Roorkee, and I did this with greater confidence, as I found that the loss of a few teeth in the spur-wheels did not affect the proper working of the machine, and that by supplying myself with spare wheels the chance of disappointment was small.

7. Up to the present period, however, we have totally failed in succeeding to get good bricks from this machine of Ainslie's: we have spared neither time nor patience in endeavouring to detect the cause of failure, and I have come to the conclusion, that the quality (a point that we shall by practice be able I hope to rectify)

of the clay used at Roorkee is not capable of retaining its form under the process required by this machine: clay of every consistency, as regards moisture and tempering, has been tried without success. Mr. Scrivener, the manager in England, writes through the Secretary of the Company, that "I am sure however, it will do "when the nature of the clay is well understood; the fault of the "brick being larger on the bottom can be remedied by taking out "the intermediate rollers, and substituting a plain board covered "with a cloth; and if it comes out rough on the upper side, you "must put a piece of wood at the back of the die to hold the clay "back, thus forcing it up to the corners; this I have done with "some clay, and always found that it had the desired effect."

8. The circumstances alluded to in this Extract, are those which I pointed out as the results of our trials, viz. that the clay in passing through the die, or former, was torn and disfigured at the edges, and that the brick itself lost its rectangular form in passing from the die upon the rollers. The latter circumstance evidently arises from the weight of the soft and unsupported material. Laying aside the tearing of the edges, the shape of the brick as turned out from Ainslie's machine in the Roorkee manufactories is thus:—the dotted line shewing the die or hole through which the clay is forced,

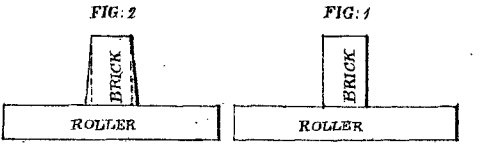


Fig. 1 shews the true form that the brick ought to assume on leaving the die.

Fig. 2 that which it takes in practice.

Figure 2 is admirably adapted to the voissoirs of small segmental arches, and the bricks so made may be turned to account in the construction of drains and culverts.

9. Mr. Finn is now engaged in making further trials with this machine; and I hope that his endeavours will be crowned with the success that he deserves.

10. When inspecting the machinery exhibited at the agricultural meeting at Northampton in 1847, I observed a brick-machine

bearing the inscription of "Hall's Patent." After further enquiry and proceeding to the Patentee, Ransome of Ipswich, at which place I visited the brick-fields where the machine was used, I was so much struck with its simplicity and aptitude for use with our native laborers, that I ordered one to be sent out to India. The accompanying reports and tables submitted by Mr. Finn, the Executive Officer of Materials, at Roorkee, exhibit the results of operations with Hall's machine during the working season of 1848-49, accompanied by a copy of the printed advertisement, and drawing of the apparatus as received from Messrs. Ransome and Co. The progress during the present year 1849-50, has been equally successful.

11. The description of Hall's machine, which is I believe an American invention, is given in full in the accompanying papers. It may be described thus:—

The clay, properly tempered, and worked up in a large reservoir attached to the pug-mill A, passes through the mill into a tray B, consisting of moulds for five bricks. This tray B, is pushed in by hand, (as shewn on the left of the sketch,) and rests upon a platform with horizontal motion gained by the use of the wheel C. By this wheel C, the tray when filled with earth from the pug-mill is pushed forward, until it comes into position under the pressing apparatus, the pressure being gained by the downward movement of the lever D. The tray being relieved from the pressure, is taken out by the hand from the front of the machine, and carried to the drying ground, where it is emptied and brought back again for further work. This process goes on as rapidly as trays can be supplied.

12. In bringing a machine of this sort into use with our native establishment, it was natural that interruption should take place in the commencement: Mr. Finn, however, had taken the precaution of drilling a party of bildars into the motions of the machine for sometime before he allowed bricks to be made with it. Brick-making therefore was commenced with very tolerable expertness; and, with the exception of slight delay from occasional breakage to the machine, and from time required to gain experience on the proper state of moisture, in which the clay was to be supplied from the pug-mill, the machine has proceeded steadily at its work. It will be observed that the number of bricks turned out daily, from the period when tolerable practice had been gained, averages 10,000, with a maximum of 11,670; an amount fully equal to that held out in the advertisement.

13. In the Roorkee fields twenty-eight men and four bullocks per day are employed. This establishment includes excavating, watering, and carrying the mould to the pug-mill reservoir, in

addition to the working of the machine. The establishment noted in the prospectus, as used in England and America, of one horse, two men, and two boys, can hardly include the labor required in digging and preparing the earth. We have found bullocks preferable to horses, and use the former accordingly. In all other respects the manufacture of bricks is carried on exactly as it would be in an English brick-field.

14. The size of the brick is 9″ by 4″ by 3″, the same as used in England. We have succeeded in burning them sufficiently, and the massiveness of their proportions, seeures them from breakage, which is an evil that we greatly complain of, in 12″ by 6″ by 2½″ or 2″ bricks, which we have been in the habit of using.

15. The cost of bricks as turned out by Hall's machine is Co.'s Rs. 54-12-2 per lakh; a rate that will in all probability be reduced. The cost of making the larger brick has been Co.'s Rs. 91-0-10 per lakh. The cost of the machine in England was £96, and the total cost at Roorkee Co.'s Rs. 1,561-8-7.

16. In consequence of the great success attending upon the use of this machine, we have made* two others in all essential respects similar. One of these is at work at the Mahewur brick-fields, on the left flank of the Solani aqueduct; and the other at Dhunowri, where the Rutmoo works are in progress.

17. A reference to the tables which accompany this paper will bear me out in my opinion, that the value of this machine is established, as a most efficient and useful accessory to a brick manufactory in India.

P. T. CAUTLEY, LIEUT.-COL.,

Director Ganges Canal Works.

MUSSOORIE:
The 29th April, 1850.

II.—REPORT, *by* MR. JAMES FINN, *Executive Officer, to* LIEUT.-COLONEL P. T. CAUTLEY, *Director Ganges Canal, dated Roorkee, 25th June* 1849.

SIR,

I beg leave to enclose herewith an abstract of the work people employed, and of the number of bricks made daily by Hall's patent machine.

* A machine of this kind made at Roorkee cost about Rs. 500.

2. The machine was set up in October 1848, and placed in charge of Serjeant Durrant, whose first object was to learn to work it himself; this he very soon accomplished, and he then taught a party of bildars how to use it; but owing to the stupidity and awkwardness of these men, the machine was continually breaking for the first six months after it was set in progress; the frequent stoppages to our work on that account were very disheartening: nevertheless, Serjeant Durrant persevered in his endeavours to give the machine a fair trial; he encouraged the bildars, with whom he occasionally took a spell at the wheel, and the results have been, that we had the satisfaction of seeing it work on steadily for the last three months, and of counting 11,670 bricks made by it in one day, which is about equal to the best turn-out obtained in England or America, from a similar machine.

3. The bildars employed on the machine were placed in the following order, viz:—

11 excavated the clay and carried it to the pug-mill cistern, average distance 130 feet.
2 supplied the cistern with water, and cleared up the drying ground.
3 filled the pug-mill from the contents of the cistern.
1 cleaned and sanded the moulds preparatory to passing them into the machine.
1 served the machine with empty brick-moulds.
1 on the wheel pressed the mixed clay into the moulds.
1 on the lever forced out the mould.
1 on the mister or strike, cleaned top of the bricks, and raised the moulds to heads of the carriers.
6 carried the loaded moulds from the machine to the drying grounds.
1 relieved the carriers of the moulds, and placed the bricks in regular lines on the drying ground.

Total 28 bildars.

4. The size of a machine-made, unburnt brick is 10″ by $4\frac{3}{4}$″ by $3\frac{1}{8}$″=$148\frac{1}{2}$ cubic inches. For 11,000, of these about 920 cubic feet of earth is required; therefore each of the eleven bildars employed on excavation, &c. had to dig, pulverize, and carry to the pug-mill cistern, about 90 cubic feet of clay.

5. Bricks made by the machine for the last month have cost on an average Rs. 54-12-2 per lakh; and the rate of our bricks with the hand on pucka terraces at Roorkee, during the same moulded month (May 1849), was Rs. 91-0-10 per lakh; pay of the bildars, &c., for Sundays, in both cases included:—size of the last mentioned brick $12\frac{1}{2}$″ by $6\frac{1}{4}$″ by $2\frac{5}{8}$″.

6. In the early part of the current month, twenty-eight bildars, at four rupees, with four bullocks at five annas each, made on an average 11,046 bricks per day by the machine, and at the same time to make 11,200 moulded bricks, the following were required, viz.,

Moulders @ Rs. 6 per month, ..	..	14
Bildars @ Rs. 4 per month, ..	..	39
	Total	53 men.

7. At the commencement it was attempted to work the machine by horses; but they were found not to answer so well as bullocks. Four of the latter animals were employed daily cutting and mixing the clay in the pug-mill;—two bullocks worked from sun-rise until noon: and two more from 2 P. M. until dusk of evening.

8. Consequent on the many times the machine was broken, we had made by it only 9,76,016 bricks in the past working season; nearly the whole of these have been stacked into a large native kiln, which is at present being fired. Some pucka bricks, however taken out at its mouth, seem close-grained, compact and strong.

9. I beg to add, that I have not included the expense incurred on repairs of the machine, in the cost of bricks produced in the accompanying Abstract.

I am, &c.,

JAMES FINN,

Executive Officer of Materials,

Northern Division,

Ganges Canal.

III.—Abstract of the Work-people employed, and of the No. of Bricks made monthly at Roorkee, by Hall's Patent Machine.

Month.	No. of day's work.	Bildars at 4 Rs. per month.	Bildars at Rs. 3-8 per month.	Chuprassees at 5 Rs. per month.	Horses at 5 annas per day.	Bullocks at 5 annas per day.	Bricks made in the month.	Cost of labor.	Cost of sundries.	Total cost.	Average cost of Bricks per Lakh.	Remarks.
								Rs. As. P.	Rs. As. P.	Rs. As. P.	Rs. As. P.	
October, 1848, ..	9	79	—	9	10	—	12795	15 12 10	4 10 11	20 7 9	160 1 6	
November, „ ..	17	52	307	17	24	32	65960	63 1 4	5 3 9	68 5 1	103 9 2	
December, „ ..	4	20	92	4	6	10	15170	18 9 9	0 0 0	18 9 9	122 10 9	
January, 1849, ..	18	444	—	16	—	48	89290	77 5 2	1 14 2	79 3 4	88 11 4	
February, „ ..	8	203	—	—	—	24	45210	37 10 3	2 6 3	40 0 6	88 8 9	
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April, „ ..	30	786	—	—	—	88	218441	136 4 9	9 12 6	146 1 3	66 14 0	
May, „ ..	31	868	—	—	—	108	287410	149 12 0	7 9 10	157 5 10	54 12 2	
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							976016			669 9 6	68 9 8	

Roorkee, 23rd June, 1849.

JAMES FINN, *Executive Officer of Materials, N. D., Ganges Canal.*

NOTE.—Half pay for a Tindal at Rs. 8 per mensem charged all through.

IV.—REPORT *by* MR. JAMES FINN, *Executive Officer of Materials, N. D., Ganges Canal, addressed to* LIEUT.-COLONEL P. T. CAUTLEY, *Director Ganges Canal Works, dated* ROORKEE, *7th May*, 1850.

SIR,

The following circumstance is I think, well worthy of being noticed in your forthcoming report on the manufacture of bricks in the Northern Division of the Ganges Canal.

2. Previous to the setting up of the first (Hall's Patent) machine, brought out by you from England, the brick-moulders were the most untractable and troublesome class of men on our works. We had then about 150 moulders employed daily at Roorkee and at Mahewur, and their combined and frequent efforts to evade the doing of a fair day's work, or to extort from us a higher rate of pay, caused much anxiety to all concerned in the manufacture of bricks. If an attempt was made to coerce a moulder, or even if fault was found with the quality or quantity of work performed by one or more of them, the whole would quit working collectively, take their moulds in their hands, and walk off to their huts, in spite of all remonstrance. I can well remember that they served us in this manner twice in one week at Roorkee. But since the machine has been erected, and the moulders saw us turn out from 10,000 to 11,000 bricks daily, quite independent of their aid, from having been the most unmanageable, they have become the most docile of all our work-people. At present we have about 200 brick-moulders employed at Roorkee, Mahewur, Dhunouri and Suleempoor: each moulder formerly made between 700 and 800 bricks on our terraces, and at present every man turns out 900 very superior ones, such as you have seen on all our brickfields, in the course of your late inspection The pay of each moulder formerly, who did what was then considered full work, averaged Rs. 6-8 per month; at present we pay Rs. 6 only, and the whole of them work on cheerfully and steadily. Taking all this into consideration, I am of opinion that our possession of "Hall's Patent Brick-making Machine" has proved an immense benefit to the works.

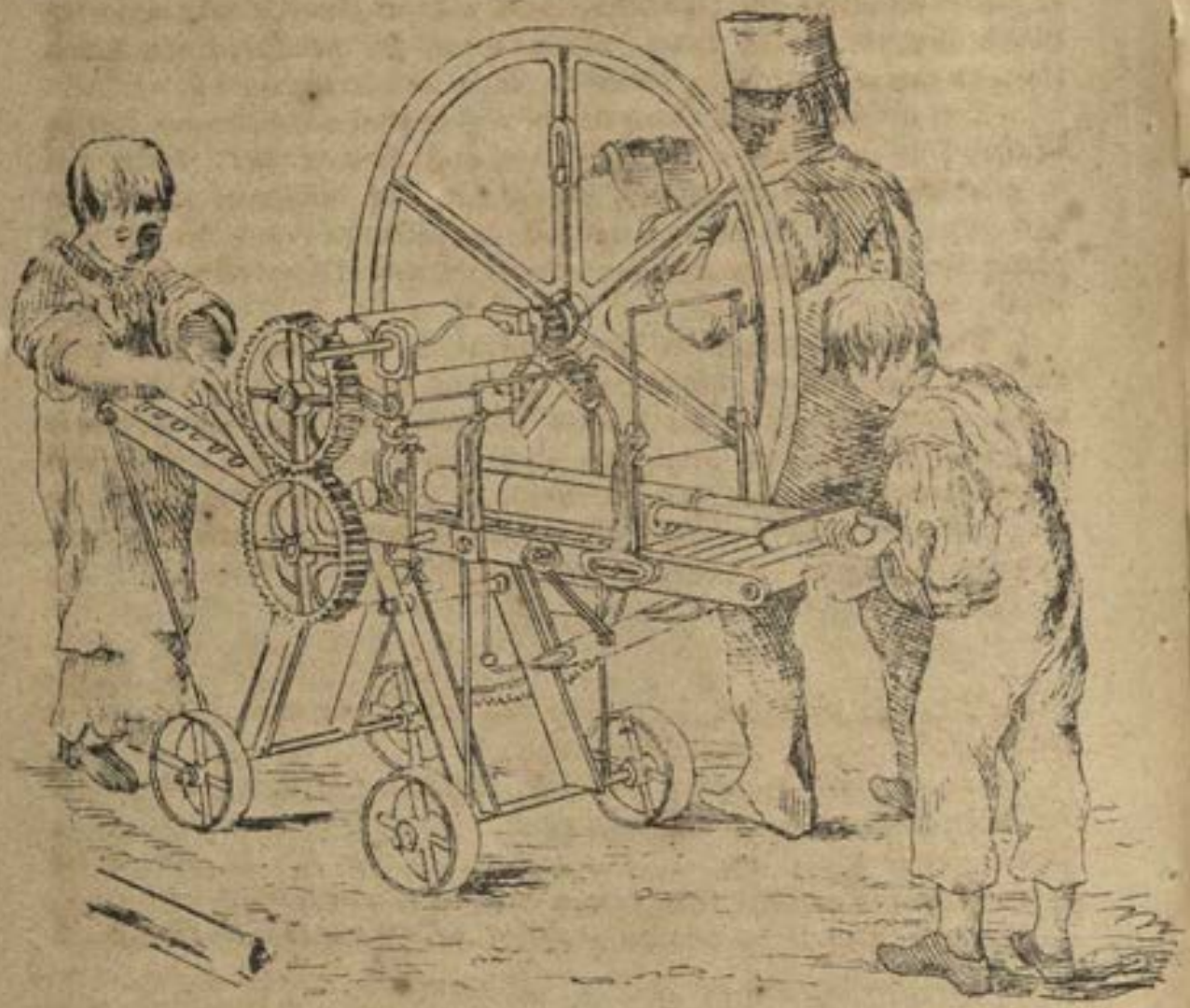
I am, &c.,

JAMES FINN,

Executive Officer of Materials,

Northern Division,

Ganges Canal.



AINSLIE'S BRICK-MAKING MACHINE

V.—EXTRACT *from the description of* AINSLIE'S BRICK-MAKING MACHINE; *by* WM. GORDON, *Secretary of the Company of Patentees.*

By these machines, (for which prize gold-medals were given by the Royal Irish Agricultural Society, at their meeting at Balinasloe, and by the Highland and Agricultural Society of Scotland, at their meeting at Dumfries, and also at Inverness), draining tiles and pipes of the most perfect form, are produced at a much cheaper rate than by any other machine hitherto invented.

The peculiarity of these machines, is that a continuous stream of clay passes between the cylinders and presses through the dies in the most perfect manner, pipes, tiles, or bricks of any form; and the apparatus is so arranged as to cut to any length and perfectly true. They can be driven equally well by steam, horse, or hand-power.

The machines are so simple in their construction, that with common care, they cannot get out of order, and any country-mechanic can easily repair them; and they are the only machines by which the hollow brick, so highly approved for building and horticultural purposes, can be made. The quantity of bricks or tiles made, depends upon the speed at which the machine is driven, varying from 4 to 15,000 per day.

PRICES.

	£	s.	d.
A hand-power machine, including two moulds or dies,	30	0	0
Additional dies, @ 10 shillings each.			
A horse, or steam-power machine, including 2 dies,	50	0	0
Additional dies, @ 15 shillings each.			
Horse-power for ditto,.....	25	0	0
A machine for making solid bricks complete, which will turn out from 10 to 15,000 per day, of 10 hours,...	60	0	0

VI.—EXTRACT *from the description of* HALL'S PATENT BRICK-MACHINE; *manufactured by* FREDERICK RANSOME, *Ipswich.*

The following particulars are copied from an American paper, printed at New York, relating to a brick-machine, for which Mr. Frederick Ransome, of Ipswich, is the Patentee for England. The machine can be seen at work at the Patentee's, Flint Wharf, Ipswich.

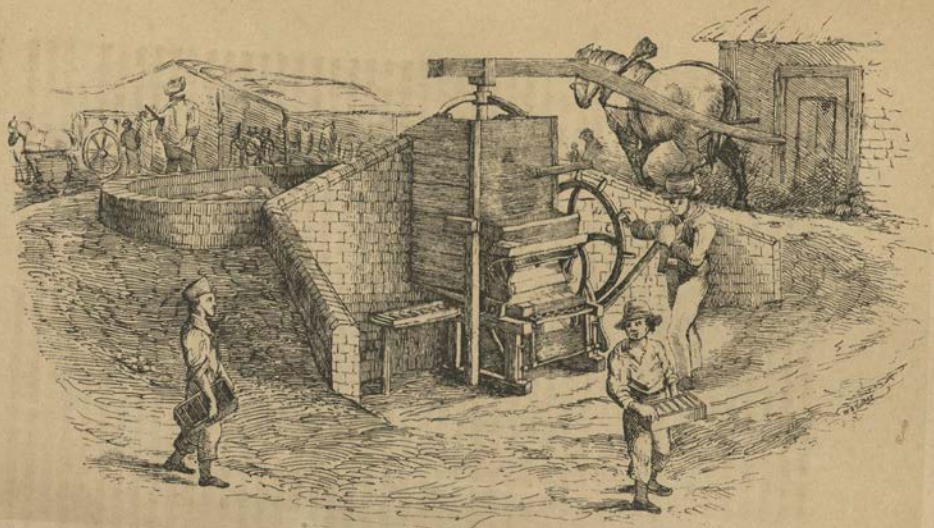
The engraving represents a machine for making brick, patented in the United States and Great Britain, by Alfred Hall, of Perth

Amboy, New Jersey; showing a pit in which the clay is soaked, the mill for grinding it, and a moulding machine as attached when in operation.

The most recent and approved method of constructing a brick yard is as follows:—

The yard should be graded so as to extend from the clay bank one hundred and fifty feet, nearly fifty feet being cut off from the side opposite the clay bank for kiln-ground; the part between the kiln-ground and clay bank, being the drying floor, should, if not made upon a clay foundation, be faced with clay, made smooth and solid, and sufficiently inclined to carry off the water immediately after rain. On the side of this floor next the clay and opposite the kiln-ground are placed the pits or vats in which the clay is soaked. These should be equal in size to one-half of a circle nineteen feet in diameter, and three or three and a half feet deep, made water-tight, and either of wood or brick (according to climate and convenience), the front or machine-side being on a line with, and facing the drying floor, and placed at distances, each to occupy or accommodate from sixty to eighty feet of the drying floor; the bottoms of the pits are on a level with the drying floor: consequently they rest on an embankment near three feet higher than the drying floor. At the centre, and in front of the pit, stands the grinding mill, a plank box resting on a solid foundation, six inches higher than the bottom of the pit; it is three feet four inches square, and four feet high, projecting fifteen inches over its foundation, so as to permit a portion of the moulding machine under the front of it. In the centre of this box is an upright shaft, in which knives are placed, and on the top of which is the sweep or lever to which the horse is attached; at the bottom and in front is an opening for the mortar to pass into the chamber of the moulding machine. The bottom of the frame of the moulding machine will stand about two and a half feet lower than the drying floor. The horse-path will be thirty-two feet in diameter, (the sweep being sixteen feet from the upright shaft to the place of attaching the horse), passing round the pit and all the machinery, inclining three feet from the back of the pit to the drying floor in front, from which point an inclined plane is graded down to the bottom of the moulding machine, for the convenience of off-levers in going to and from it. A box containing sand for moulding is placed near and at the left of the machine.

The clay, unless it is soft like putty or dough, works best generally to plough and dry it, putting the water in the pit first. The dry clay is then shovelled in—not in heaps, but scattered so that every shovel-full shall go into and under the water, scattering the clay continually in the deepest, and using up the water, and



HALL'S PATENT BRICK MACHINE

rising above it only when the pit is full. It is left thus to soak over night, when it is ready to grind.

Having thus prepared the yard,—with the kiln-ground on one side and the machine on the other, the drying floor between, and a vat containing water convenient to each machine to soak and wash mould in, and having dried and sifted through a fine sieve, a quantity of fine, sharp sand (the particles pointed and flat), for moulding,—we are ready to commence work. It is the work for one man to shovel the clay from the pit into the grinding mill; he adds a little water in the mill, as it may require; keeps in as even temperature as possible; keeps the mill full, and the horse in motion. The mortar passes continually, as it is ground, out of the opening in the mill, directly under a revolving press, into the chamber of the moulding machine, at the bottom of which is a grate, under which rests the mould, on rollers, in front and rear of which are grates; the grates and rollers, forming the top of the main carriage, the sides of which are kept about one inch from the plates by steady pins, which serve also to keep them from oscillating, and having (at their rear end at the outer edge) iron rails, the whole being constructed so as to allow all surplus sand and rubbish freely to riddle through. It is supported in rear by a girt, suspended from the plates by screwbolts, the front resting on rods connected with a shaft, to which is attached the lower small lever, which, being drawn forward, instantly drops the front of the carriage, and releases the moulds from obstruction by stones or otherwise. On the iron rails runs a moveable carriage and an axle having wheels to run on the rails, to which is attached a crutch lever, curving so as to connect with the axle, thence passing forward is connected with an arm or lever extending to a shaft below, to which is attached the large lever, which attaches this moveable carriage, so as to force the empty mould under the chamber, and the full one out on to the front of the carriage. The upper small lever operates the press by means of a shaft with pinions operating in segments.

The operation of moulding is simple. The mortar passes directly from the grinding mill, in a confined state, into the chamber of the machine through the grate into the mould. The press lever is then brought forward, pressing sufficiently to fill out the corners, the pressure being kept on till the mould is filled and started by means of the large lever. As soon as the full mould starts, the press lever is let go, and when the mould is drawn out, both the levers are replaced ready to repeat the operation. The moulder then smooths off the upper surface of the brick, by drawing a strike (the mettle edge of which may be wet in the small box in front of the larger one resting on the machine) across them,

cleaning off the box; the lower lever is used only to drop the carriage when the mould is obstructed, and then immediately replaced.

From four to five hands compose what is called the moulding gang: the shoveller, called a machine tender, a moulder, and from two to three off-bearers. These must all move on regularly, and keep up with the horse; they will make from eight to fourteen thousand bricks per day; the number depending upon the size of the brick, and the convenience of the works. New moulds should be thoroughly soaked before using. The off-bearers, while the moulds are wet, sand them by dipping sand from the sand box, and shaking it till every part of the inside becomes coated, when each puts an empty mould on the machine directly back of the full one, and between it and the axle, and then takes the full one from the front, in such a manner as to place the side coming last from under the grate next to him. Carrying it to the drying floor, he carefully turns it on the floor bottom up, leaving the brick in rows running from the kiln ground towards the machine. He then immediately returns, re-sands his mould, and repeats the operation.

When the business is carried on to much extent, it should, as far as practicable, be arranged into a system: the work should be so arranged that each hand should be kept at the same kind of work; the departments of labour and terms applied are as follows, viz., the teamster, pit-filler, moulder, temperer, off-bearer and yard-hand. The teamster ploughs and scrapes the clay and does all necessary team work, the pit-filler delivers the clay, and fills the pit, the temperer shovels it into the grinding mill, the moulder makes it, making from five to six brick at each impression, and the off-bearers carry the brick and lay them on the floor to dry, the yard hands take care of them from this stage till they are set in the kiln ready to burn. Each man is employed as a suitable hand to do one of the various kinds of work, and expects to be kept at that kind of work through the season, and each becomes skilful in his particular department. It is found that men will do more work,—do it better—with greater ease, and be better satisfied to be kept constantly at one kind of work, than changed from one kind to another; the muscles called into action by a particular kind of work soon become, as the common saying is, seasoned to it, so that they are not easily fatigued,—but change the work, and other muscles are called into action, which soon tire. Brick should not be taken from the yard until dry, and when dry should be taken directly from the yard and set in the kiln. It is very little, if any more work, to set them at once in the kiln, than to carry and bake them (as the practice is at the south) under

sheds, and they will dry more thoroughly on the yard, than in *hakes* under a shed where they cannot receive the sun, and it is about as much work to take them from the shed and put them in the kiln, as from the yard. If room is wanted to keep the moulding gang at work, the yard hands will *hake* them on the yard, running the hakes from the kiln towards the pits. Brick are then laid between these hakes to dry; this process saves handling, the brick becomes better dried, and the corners and edges less injured than by the other process.

What is called the burning shed, is constructed by setting two rows of posts to stand on each side of the kiln from 18 to 20 feet apart, ranging so as to accommodate the arches, which will vary according to the length of the brick, leaving five or six arches between the posts; these posts should rise three feet above the kiln; plates should be framed on the top, and connected with iron rods, passing from one plate to the other over the kiln to keep them from spreading by the weight of the roof; rafters placed about six feet apart rest upon these plates, ribs or slates are placed across the rafters on which rests the roof of boards; on either side of these posts, and at a distance of ten or twelve feet therefrom, are set two other rows of posts having plates framed on the top sufficiently high to pass under with teams, &c. These form wings to the main shed, and should be covered permanently. When a kiln is burning, and becomes so hot as to endanger the roof of the main shed, the boards should be slid therefrom on to the wings, and replaced when the kiln is sufficiently cool.

No. XLVI.

ROAD-MAKING IN THE HILLS.

No. I.—Principles laid down by Major J. P. Kennedy, for the guidance of all persons engaged in constructing the road from Kalka, through Simla, to Kunawur and Thibet.

Every road should have its line as level, and its surface as hard, smooth and non-elastic, as circumstances under the most scientific management will allow.

The subject of road-making may be divided into two general branches:—

First.—The laying out of the line.

Second.—The construction of the road.

LAYING OUT OF THE LINE.

When the grave charge of initiating the improvement of a district of country, by the construction of roads, is committed to a man of judgment, his first care will be to consider the features of the country, not only within his immediate charge, but far beyond those limits.

He should divide his road projects into three distinct classes. The first and most important containing the lines of general intercourse; the second containing the roads for merely local objects, and communicating with those of the first class; and the third containing the farm roads communicating with those

of the second and first. He should not, upon any account, permit the perfection of his roads of the first class to be in the slightest degree injured for the benefit of those of the second or third classes. His great lines of intercourse must be laid out solely with reference to the general levels of the country, and to the permanent markets, to which producers may afterwards have to convey their goods. If he think only of his own little district at this point of his operations, he will materially injure it, as in that case his general lines will probably not be such as to invite general traffic, and the mercantile interests of his district will be proportionally impeded. The co-operation of the circumjacent neighbourhood is essential to the improvement of any given spot of country, and must be earnestly sought for. Keeping these considerations constantly in view, we may now proceed to the rules applicable to all branches of laying out, viz :—

1st. That the line must never rise or fall unnecessarily ; it must go round, or cut through impediments.

2nd. That the quantity of ascent or descent, when such is unavoidable, should be divided uniformly over as long a distance of the line as the nature of the ground will permit, and thus the inclination at each particular part will be reduced to the smallest possible rate.

We should recollect that the loads carried along roads must be small in proportion as the inclination of the hills is great; that the steepest hill, in fact, regulates the load.

We must never forget, in laying out a line of road, that on an inclined plane or hill, of which the surface is hard and smooth, when any power holds a heavy body in equilibrium, the power exerted will have the same proportion to the weight as the height of the plane or hill bears to its length ; and secondly, that whilst the effect of the load increases, the power of the animal employed to draw it diminishes in proportion as the degree of inclination increases. These two facts should never be absent from the road-maker's mind.

When this subject is fully understood, it will be evident that the ignorance of a person who undertakes to lay out a road may, and very often does, make the transport of commodities amount to many times what it should cost. There is little doubt that the greater number of the hills we generally find on roads might have been either wholly avoided, or their inclination very much diminished, by judicious laying out; and the greatest evil is, that the only wise remedy for such blunders is to make a new piece of road where they exist, and if they are numerous, to change the entire line. The common mode of correction is to cut down in some degree the hill, and to fill up a little the hollow ; but this method

rarely reduces the inclination as low as the natural features of the ground would allow; and it generally costs much more than would be necessary to put the road in its right place by laying it out afresh.

The correction of hills on old roads has been alluded to here, to show the importance of extreme accuracy and sound principles in selecting an original line. Every Superintendent will now understand that if an error be made, it cannot be thoroughly remedied without abandoning that portion of the road where it exists, and taking up a new line, thereby losing the capital already invested, and injuring the speculators whom the road may have brought there; but if there be an error of construction, as for instance, the use of soft materials instead of hard, or the like, all this can be set right without abandoning the old line. The power of getting level roads by cutting through hills and filling up hollows is not disputed; and in laying out a line of railroad this method must be adopted, because the velocity of the steam-carriage will not allow of such rapid curves as a road must take which follows the natural inflexions of our hills; but the expense of such cuttings and embankments is so enormous, that to think of them for the ordinary roads would be quite out of the question. Our necessities frequently require that farm roads should be made, that roads for approaching minor villages, &c., should be made, and that extensive districts of almost unexplored countries should be intersected by numerous lines of general communication. If a costly kind of road be attempted in such cases, the necessary results cannot possibly be produced, because the necessary funds could not be provided; still it is essential that as accurate a regard should be paid to their laying out, as if they were to be immediately constructed on the most perfect models, and that the levels be the very best that the nature of the country will admit of. We must provide from the commencement that every successive operation shall tend to bring them ultimately to a state of the very highest perfection, and that nothing shall ever have to be undone.

False ideas of economy and inadvertence frequently lead to the employment of men who do not understand the principles of these essential operations, although they attempt to execute them, and hence the eternal toiling up and down hill to which they, their neighbours, the public, and future generations are condemned. Most amateur artists are time-killers and money-wasters, but of all the amateurs in the world, the road-maker is the most mischievous; there is no method of avoiding his ingenious contrivances to harass the weary traveller and reduce the profits of industry.

The first thing to be done, when it is determined to open a road between any two points, if they be distant, is to get the maps of the adjacent country, and to become thoroughly acquainted with

every inch of the intervening ground in all directions, particularly the course of rivers.

If it be a hilly country, the greatest possible attention must be given to choose the most convenient passes of mountains with reference to their height, and the highest passes of valleys, which in all cases, must be considered as obligatory points of the line. The selection of these, therefore, is to be considered the first and most important point of laying out, and nothing short of *mathematical proof* of their superiority to all other points ought to satisfy the Superintendent that he has selected the right points.

It is much to be regretted that the Survey Department of India has not furnished the public with that most important class of information, a contour delineation of the hills; the want of which must be remedied by increased industry in all those who are engaged examining the country with a view to the selection of the line.

The most disadvantageous circumstances under which it can be required to lay out a line of road is, where the direction runs at right angles across a line of hills, to the passes of which there are no convenient approaches by means of under-features; this obliges us to resort to the expedient of zig-zags. There is no difficulty in laying out such a road to any required degree of inclination; but when done, it is always dangerous, as it is not possible to avoid very acute angles, which on a declivity, are most objectionable. If an animal run away with a carriage in descending such a road, the first turn he reaches will probably finish the mortal career of the whole party.

The rule in such a case must be, to make as few turns as possible; and in general, there need not be more than one on each side of the mountain.

Having obtained a knowledge of the relative heights, as above described, both from maps, and by taking lines of section with the level, and having thus selected all obligatory points, we may now proceed to the operation of marking out the exact line between all the points thus selected. This is done by fixing up pickets with flags attached, in the required slope, by means of either the plummet-level or a spirit-level, having a graduated vertical limb. These flag-pickets may be placed at intervals of about one hundred yards, more or less, according to the bends in the hills, taking care that one is put at every projecting and every retiring angle of the ground, and that from each picket the one on either side is distinctly visible. We proceed thus until the whole line is picketed off, observing to correct this line, if requisite; and it rarely happens that the pickets can be placed precisely in their right permanent position at the first trial.

Having got the long pickets accurately placed, the ground should be distinctly marked at each picket by cutting a cross, or some other convenient sign; and the second operation must be commenced by placing short pickets with the boning rods at intervals of about eight yards between the long pickets.

Third operation. Having placed the short pickets, long lines are then laid to the foot of the pickets, taking care that the lines run round all obstacles, and not over them. When these lines are fixed, some expert laborers, accustomed to the work, may be placed to cut out the lock-spitting exactly to the level of the line.

This operation should be done with great accuracy, that there may be no necessity for correction afterwards, and handy men, accustomed to the work, should be employed in lifting the lines and laying them again, as the lock-spit cutters proceed. This lock-spitted line being the sole regulator of the levels, must be examined, and re-examined to ascertain that in every part it has been accurately cut. The person charged with such a work must not spare himself at this point upon any account. Let him then bring every one whose opinion is worth having in the neighbourhood, to visit and criticise what he has done; let him reflect that, by any idleness or stupidity on his part, he passes sentence upon countless generations to suffer inconvenience and unnecessary toil for his omissions. The lock-spitted line, when completed, is not to be considered as any thing but a gauge for the general level of the surface of the road. It is not the centre, as some suppose, although, upon a general principle, the nearer the centre line comes to it, the cheaper will be the forming of the road, and the more we diverge from it, the more costly it will be where the features of the country are of a hilly character.

With the completion of the above described lock-spitted mark, neatly cut along the whole length of the projected road, we shall consider the business of laying out the line to have been executed; and in order the more clearly to separate this most important operation from all others, we shall consider the subsequent picketing, ruttings and marking off the details, as appertaining to the subject of construction.

The average cost of cutting this gauge-line or lock-spit, independent of the preparatory surveying and superintendence, ought not to exceed four or five shillings per statute mile—that is to say, for the actual pay of the laborers employed to execute it; and when completed, it ought to exhibit a perfect level or a perfectly uniform incline, between every two of the obligatory or main points, and following every horizontal inflexion of the ground, it ought to stand the test of any instrument, and be pleasing to the eye. The want of accuracy in the laying out of public undertakings, is the

source of that constant doing and undoing, or playing at blind-man's buff with the work, which we so often see; doubling or quadrupling the proper cost, and leaving most discreditable results. The economy and perfection of the work will be in proportion to the judgment and accuracy applied in the laying out and making of this gauge-line, as it gives us the key by which to regulate with the utmost precision, every subsequent effort of every laborer we employ, and to point out where every spadeful of excavation is to be dug, and permanently deposited with the smallest amount of exertion. We shall next proceed to the subject of

CONSTRUCTION.

As soon as the lock-spitted gauge-line shall have been well considered and criticised, and all necessary corrections completed, it may be widened into a 5-feet track. The next operation is to fix the pickets for the centre of the road.

This will regulate first the cost, and second, the appearance of the work when complete. We must avoid objectionably sharp turns; but we must also studiously avoid heavy cuttings and fillings, and we must make our curves regular. These three points can generally be combined; and they must be combined, otherwise, the Superintendent cannot be qualified for his charge. He should never have his eye off the gauge-line, and as each picket is placed, it should be accompanied with a mental calculation as to the quantity of cutting and filling, and consequent cost it will require to bring the road at that point to its proper width, and to the level of the gauge or lock-spit. He will bear in mind that as often as he can place a picket exactly at the lock-spit, without infringing on a principle, he should do so, as then the forming of the road will cost the least possible sum; unless when he has to deal with rock which requires blasting. He must at all times think of his finances, taking care that the amount of money or labor estimated for the work shall be made to complete it, and he will be justly culpable if it fall short, as this consequence is very rarely attributable to any other cause than unfitness in the Superintendent. The wrong placing of a few pickets may cause a piece of work to cost double or tenfold, nay, a hundred times more than it should cost; and it is clear that the man who can perform the most perfect work at the cheapest rate, must at all times earn character in proportion. It is evident that there may be a very great variety of curves made for rounding off the angle which the lock-spitted gauge-line forms in passing a valley or ravine, and that the more the curve is carried out from the angle, the better will be that particular part of the road, but it must be recollected that the slight improvement thus effected on one spot, is attended with

most disproportionate cost ; and, if a man deficient in judgment be placed in direction of such works, he may use very fine arguments as to the utility of gradual curves, and the like, but the result will be, that instead of succeeding to fulfil the object of his employer, by opening in its full length a useful line of intercourse, he will find all his money expended on two or three fantastical embankments. He will leave the district as closely sealed up as he found it, and his employer will be justly disgusted with such costly enterprises. If he desire to serve himself, and to be useful to his neighbours, he will follow, as nearly as possible, the natural features of the ground ; unless when there is the most indisputable reason against this ; and keeping a watchful eye upon the money chest, he will never sacrifice the general result to any chimera whatever. This cutting and banking mania is the grand source of wasteful expenditure in the construction of our roads.

If, instead of going uniformly along the side of a hill, and making our road with the minimum of cutting and filling,—if, instead of this, we seek to torture it into straight lines, still keeping to certain predetermined levels, the line of road must be a succession of deep cuttings and high embankments : costly at first, and costly to the last, from their liability to dilapidation.

As soon as the centre line shall have been cautiously picketed out, all the side lines must be measured from it and distinctly rutted out upon the ground, taking care to lift the several shear-sods. These lines will show the verges of the road, the inside and outside of the fences when such are made on the road, and the width of the water-tables, as well as the position of the catch-water drains. Accurate *bonings* must be put in at every picket in the centre line, which will thus be level with the opposite points of the lock-spit gauge, and a correct longitudinal section must be made up between these pickets.

Cross section lines should likewise be made up to the intended level of the road at every 100 yards, showing the precise fall that the road is to have from the centre to each side, when formed. But in making up longitudinal and transverse sections, it is necessary to observe whether the soil be of such a nature as to answer for the soling, or whether it be of so defective a quality as to require a superstratum to prepare it to receive the broken stones or surface gravel ; and a corresponding distinction should be made as to the height to which the section lines should be raised in different places. If the natural soil be of the right quality for soling a road, it would be an unpardonable waste to require that more of the same description of material should be excavated elsewhere, and brought upon it, although we have known such surprising extravagance set forth in specifications. The cross-slope

given to a road should vary according to circumstances. If its maintenance and repair be carefully provided for, on level ground a fall of one in twentyfour from the centre of the sides will be sufficient. If there be any doubt as to the future care, the best precaution is, to increase the cross-slope as a security against surface water, and in all cases it is well to make the cross-slope somewhat greater on declivities than on the level ground, in order that the path of all surface waters may be directed in the shortest lines to the water tables; under these different circumstances, the cross-slopes may be made to vary from one in twentyfour to one in twelve, and they should be accurately proved by the section level.

It is well to know that some authorities on this subject have recommended the cross-slope of roads on declivities to run the whole way from the outside verge to the inside, whilst others advise just the reverse, and not from the centre to each side. The chief object of the first recommendation is, to prevent the corrosion of the outside verge by the surface water, and that of the second to prevent any accumulation of water in the water tables, but they both appear to be most objectionable in practice, as they necessarily throw every carriage off its level, and bring an unequal portion of the load on the wheels of one side. They also give a longer run to the surface waters on the road. No professional man should permit so serious an inconvenience to be inflicted on the public. His ingenuity ought to provide a remedy of a different kind. As soon as the longitudinal and cross sections have been made up to the right level, the work may be considered in a state to employ large forming parties, who after this preparation, can scarcely commit errors, if there be any degree of activity in the overseers.

When the road is constructed upon level ground, it is desirable to make two side fences with water-tables outside of these; when it is on sloping ground, one side fence will suffice, the cut face of the bank forms the other.

It is evident that on sloping ground, the Superintendent, who desires to execute his work with economy, must use every exertion to provide that the quantity of cutting shall, as nearly as possible, agree with the amount required for filling, that he may not be obliged to carry materials either to or from the place where he works.

The materials used for fences, retaining embankments, &c., will depend upon the nature of the soil in a great measure; and the best proof of skill, in this or any other art, is the power of making the most possible out of the circumstances in which we are placed. The man who cannot supply himself from his own vicinity, would fail, if he had Guernsey granite and mines of gold at every perch of his progress. When the soil is stony the fences and faces of

embankments would naturally be made of this material, and, when built dry, they should have a slope of one-fourth of their height. If sod work be used, the slope should be increased to one-third of the height, and when a bank of earth or other material is faced without being supported, the slope will depend on the quality of the soil, observing to give the greatest slope to the most friable soil, and it is for the Superintendent to observe the natural slope at which each kind of earth will continue. The best soil that we can meet with in constructing roads is gravel; because, in the first place, it has natural drainage; secondly, when the road has been formed in such a soil, it is both soled and metalled unless the traffic be of a very heavy description.

In making a road through any spongy or soft soil, it is well to let the work season after the general drainage and forming have been effected before proceeding further. When embankments are filled up, a considerable allowance must be made for sinking, and after allowing them to season, they should be again levelled up. If these points be not attended to, or if the work be hurried over, it will look well at first, but afterwards it will show many inequalities and defects that might have been avoided.

The liberal use of a heavy roller is an excellent way of consolidating the surface of a new road, preparatory to opening it to the public, and the difference in the quality of both gravel and stones should be well understood by every road Superintendent. Some stones can be broken with more profit to the workmen at one anna per ton, than others at six annas, and where heavy carriages are in use, the low priced stone is, in general, the more costly in the end. We must recollect that the price of breaking the stone forms but a portion of the cost of metalling a road, and the most durable material to be had within any rational limit, as to cost, is at all times the most desirable. Contracts for stoning, therefore, should always specify the precise kind of stones required, and from what quarries they are to be taken; and no one can be considered properly qualified for superintending such works as we are now considering, unless he have acquired a thorough knowledge of the several varieties of rock common in the country, with the different qualities and properties peculiar to each.

When we estimate the cost of a new road, we should divide the whole into three very distinct general heads. The first may include all the expenses of surveying, laying out, forming, draining, fencing, soling, gravelling, and all else preparatory for the stoning. The second head should show the cost of the stoning or metalling, and should detail minutely the quality of the stones required,

and the quantity per perch; allowing a larger dimension to the broken stones in the bottom, and a small dimension at the surface. The third, the cost of the masonry, bridges, pipes and tunnels if any.

It is extremely essential to separate thus the great heads of expense, in order to enable *all persons* to understand the way in which the total cost is made up on different descriptions of work, and, as it were, to get rid of that professional mystery which is generally made to envelope every thing relating to the expenditure of money.

The details here included under the first head are such as are required, with but little variety as to their application, in all projects for new roads, and their cost may be made to vary from 100 to 600 rupees a mile, according to the peculiarities of soil in which we are working. The second head, or metalling, may be either wholly omitted in certain cases, or it may be adopted to any degree that the circumstances render necessary. For instance, three tons of tender stone, at one or two annas a ton, may be thought applicable fort he exigencies of one case, when in another it might be indispensable to apply twelve tons to the perch of the hardest stone to be had, at a cost of perhaps six or eight annas per ton; thus making the rate for this branch of cost vary, from three or four annas, to 100 annas the perch, according to the means applicable for the construction, and the intensity of the traffic to be expected. The third general head, including pipes and masonry, is also capable of being effected in various degrees of excellence, and at proportional rates of cost, which can only be regulated by comparing the necessity of the work with the funds applicable for its construction.

J. P. KENNEDY, MAJOR.

SIMLA:
June 15th, 1850.

No. II.—Hindostan and Thibet Road.

Rules for Superintendents, Overseers, &c. &c.

Officers employed on the survey of the line are to send in reports of their observations, at least once a week, addressed to Major Kennedy at Simla: these reports to be accompanied by sketch plans and sections. The plans to be on a scale of two inches to one mile. The section horizontal scale to be likewise two inches to one mile, and the vertical section 200 feet to one inch.

2. The maximum incline is not to exceed 3 in 100 or 1 in 33⅓; and every exertion must be made to keep the inclines as much as possible *below* this maximum.

3. The whole line is divided into Superintendent's divisions, and each division to be designated by a letter.

4. The point from which all measurements are to be taken is marked by a picket sunk opposite Mr. Vivian's house in the Simla bazar.

5. The 1st division, commencing southward, is denominated the A, or Krole division; the 2nd B, or Simla division; the 3rd C, or Mahassoo division; the 4th D, or Muttiana division; the 5th E, or Kotegurh division; the 6th F, or Teranda division; the 7th G, or Chini division; and so on to the end of the line northward.

6. All reports to be made on foolscap paper, and marked at the head of the report with the divisional letter, to which the portion of the line it refers belongs, as well as the territory. It will be folded in four, and docketed on the back by the Officer who sends it, with the divisional letter and the substance of the report.

7. All Officers will be expected to keep copies of their reports, plans and sections, for the convenience of future reference.

8. All Officers employed in surveying the line as well as Officers in charge of divisions, and Overseers in charge of sections, and also Assistant Overseers, will be required to make themselves thoroughly acquainted with the printed paper containing the "Principles of laying out and constructing the works," that a uniform practice may obtain throughout.

9. The working parties are to be kept under the superintendence of their respective mates; and each Sapper Overseer is to be appointed to his distinct and separate charge, consisting of one or more mate's parties, according to the strength of the whole party as shewn in the following table:

Composition of an Overseer's party for working a section of 10 *miles of the line.*

Two or more Overseers' sections to constitute a superintending Officer's district.

Sappers.		Mates and Laborers.														Remarks.
		When Working single force.		*Double force.*		*Triple force.*		*Quadruple force.*		*Quintruple force.*		*Sextruple force.*				
Overseer in charge of Section.	Assistants in charge of sub-Section.	Mates.	Laborers.	Mates.	Laborers.	Mates.	Laborers.	Mates.	Laborers.	Mates.	Laborers.	Mates.	Laborers.			
												1	50			
												1	50			
				1	50	1	50	1	50	1	50	1	50			This composition of the working parties will enable one Sapper Company to furnish Overseers for ten Divisions, extending over about 200 miles. It gives us the power to employ efficiently under them from 2,000 to 12,000 men a day.
	1	1	50	1	50	1	50	1	50	1	50	1	50			
				1	50	1	50	1	50	1	50	1	50			
										1	50	1	50			
												1	50			
				1	50	1	50	1	50	1	50	1	50			Until the line is opened to 6 feet wide, the pickets shewing each man's working ground must be placed when working in clay, or gravel at seven yards a part, and in rock at two yards apart.
	1	1	50	1	50	1	50	1	50	1	50	1	50			
												1	50			
												1	50			
1												1	50			A party working in *double* force would thus cover upwards of 1½ mile in clay, or about ½ mile in rock work, and it is probable that the double force would in the first operation be better looked after than a more extensive party. Working our 10 divisions at double force would give us 4,000 laborers. When the widening of the road to its full extent commences wall building, &c., then the larger forces may be called in with profit.
	1	1	50	1	50	1	50	1	50	1	50	1	50			
												1	50			
												1	50			
				1	50	1	50	1	50	1	50	1	50			
	1	1	50	1	50	1	50	1	50	1	50	1	50			One of the Assistant Overseers should always be a miner.
												1	50			
												1	50			
												1	50			
	1	4	200	8	400	12	600	16	800	20	1000	24	1200			

10. During the rainy season the working hours must depend upon the weather, the Overseers using their discretion as to the hours for meals. When the weather however is fine, every party must be at work at 6 o'clock A. M., the dinner hours to be from 11 till 1, and to leave off work at 6 P. M.

11. As much waste of time occurs in mustering large parties of laborers, when this is not done with care, the Overseers are required to put the men at once to work under their respective mates, at the established hour for commencing. The chief Overseer will then immediately go round, and muster each mate's party separately, noticing the absentees. Thus only one mate's party at a time will be diverted from work for this object.

12. A daily report in the following form will be sent from each party, showing the number of those present, and the quantity of work done during the day, as well as the total number of days' work from the commencement, and the total work done in the section.

Section *Division Road Report,* *day of* 1850.

(Territory of)

	Sergeants.	Corporals.	Native Officers.	Native Non-commissioned Officers.	Sepoys.	Mates.	Coolies.	Total.	Road opened in yards. Lockspitted.	To 5 feet.	Road completed.	Remarks.
Total brought forward from commencement of work,												
On day of 1850,												
Total, ...												

Examined,———— ————

In charge of Division. *Overseer in charge of Section.*

These reports will shew the mileage cost in labor at which each Overseer is performing his work, and will afford a good comparative scale of the value of each Overseer, and the names of those whose efforts prove them to be most deserving, will be forwarded for the favorable consideration of Government.

13. Before the parties are dismissed in the evening, every mate must be informed of the precise point where his squad is to assemble on the following morning.

The distribution of the men, by assigning to each a regular portion of work, marked off by pickets, and sufficient to occupy him for the day, is the most important duty of the Overseer and his Assistants. By this method a fair principle of task work can be established; and there is no other remedy against idleness, and consequent waste of the public resources. The omission of this practice frequently makes public works cost from 10 to 20 times the proper amount, and every Superintendent and Overseer employed in the present works, will be held strictly responsible for the execution of this essential rule.

14. The breaking of tools is entirely attributable to the carelessness of the Superintendents and Overseers, by allowing the weaker tools to be applied to the work of stronger ones. The pickaxe and the hoe are frequently destroyed by attempting to remove heavy stones with them; a labor which ought to be reserved for the crowbar, the sledge and wedge.

15. The present deficiency of crowbars, sledges, mining tools, &c., will gradually be remedied. In the meantime, Overseers must employ the weak tools at the clay and gravelly portions of the work, where after a 5-feet track has been completed, with convenient passing places 12 feet wide, the width of the road may then be generally increased to 12 feet, with passing places of 18 feet wide at salient and re-entering angles of the ground, and at other convenient places.

16. The ultimate width of the road may be considered at 18 feet throughout, with the exception of difficult cliffs, where the width of 12 feet will suffice. In every part of the road, a retaining wall, on the side of the precipice, will be requisite to completion, with a parapet raised two feet three inches above the road level. Small weep holes, four inches square, to be constructed under the parapet, for the escape of the surface water, at every 50 feet.

17. At every re-entering angle of the ground, and at distances not exceeding 100 yards, substantial cross drains must be made under the road, of ample dimensions, to carry off all the water that can be expected in the heaviest rains, and, in no case, are these drains to be of smaller dimensions than four feet high on the outside, and two feet wide, which is sufficient to admit a man to clean or repair them.

18. Great care must be taken in preparing sound foundations for all walls which, when built dry, as retaining walls on the outside or precipice, should have a slope of one-fourth of their height, and a thickness, at their foundation not less than one-fourth of the height,

plus two feet six inches. These retaining walls it is not desirable to make generally more than four feet high, exclusive of parapets although many emergencies will render much higher walls occasionally requisite.

19. In opening the first 5-feet track, where very difficult cliffs occur in the line, temporary tracks may be made either above or below the proper level, as the nature of the case may permit, taking care, after passing the obstacle, immediately to regain the proper level. By this means an immediate passage can be obtained long before the permanent passage could be made in its proper position. And it is desirable that such temporary passages should be above rather than below the proper level, because, in that case, the progress of the permanent track in its proper position along the cliff, will not be impeded by persons passing on the temporary track. These temporary tracks should be suitable for the passage of mules, and they may, in many cases, be made to occupy either the brow of the cliff, which shall ultimately be worked down to the road level, or the foundation of a wall to be subsequently built up to that level.

J. P. KENNEDY.

SIMLA :
June 15th, 1850.

No. III.—Labor-works Department.

Section *Division,* *Hindostan and Thibet Road Return of labour for the month of* 1850.

Pay Department.

Trades.	Names.	Month of 1850.	Total time days.	Daily pay in annas.	Total amount during month. Rupees.	Annas.	Pie.

Trades.	Names.	Month of 1850.	Total time days.	Total amount during month. Daily pay in annas.	Rupees.	Annas.	Pie.

We the undersigned hereby certify that the persons abovenamed have been present at work for the time specified opposite their respective names.

Overseer in charge of Section.

Superintendent in charge of Division.

I certify that I have paid to the several individuals abovenamed the sums opposite their names.

Accountant's Pay Clerk.

We certify that the several individuals in the above list were paid the sums opposite their names in our presence by Mr. ——————, Pay Clerk.

Overseer of Section.

Superintendent in charge of Division Work.

FORM OF REQUISITION FOR TOOLS AND MATERIALS.

Required for use at the Tunnel on the Hindostan and Thibet Road,

5 seers Steel,
4 seers Iron,
1 Dubba Oil.

W. NAPIER.

Simla, 25th September, 1850.

(Approved)

J. P. KENNEDY.

Received the above articles,

W. NAPIER.

FORM OF BILLS FOR TOOLS AND MATERIALS.

DR. THE HON'BLE E. I. COMPANY.

For materials on account of the Hindostan and Thibet Road.

5 seers Steel	@	per seer,	0	0	0
4 seers Iron	@	per seer,	0	0	0
1 Dubba Oil	@	per seer,	0	0	0
		Total Rupees, ..	0	0	0

September 25th, 1850. (Signed) A. B., *Merchant.*

Certified that the above weights and prices are correct.

(Signed) T. GRAHAM, *Accountant.*

September 25th, 1850.

Received the amount of the above Bill in Co.'s Rs. —— Annas —— Pies ——

(Signed) A. B., *Merchant.*

Certified that the above sum was paid in my presence.

September 25th, 1850. (Signed) C. D.

No. XLVII.

COWREE-RAM BUND, AND ROADS IN GORUCKPORE.

No. I.—LETTER *from* H. C. TUCKER, ESQ., C. S., *Secretary to the Road Fund Committee of* GORUCKPORE, *dated* 22*nd January* 1850, *and addressed to* E. A. READE, ESQ., C. S., *Commissioner of the Benares Division.*

SIR,

In obedience to the verbal orders of the Lieutenant Governor, given on Friday last, in camp at Babutpore, zillah Benares, I have the honor to submit a brief report on the Cowree-Ram Bund. As I leave the district to-morrow, the plans, though correctly done, are not as neat as they might be; and the report, in the bustle of making over charge of the zillah, is necessarily hurried. In truth, I had hoped to have escaped the necessity of writing a report at all; as I would at any time rather do a thing, than write about it when done.

2. The city of Goruckpore is cut off from Azimgurh and the districts lying beyond, by the valley of the Amee, which extends about 20 miles from Mr. Robert M. Bird's noble bridge at Chuttaee to where the Amee falls into the Raptee below Cowree-Ram. The Amee itself is a deep narrow river, and has two large bridges on the upper part if its course; but during the rains, the whole valley to a breadth of $2\frac{1}{2}$ miles is full of water, and communication with the civilized world almost entirely cut off. It was no uncommon circumstance for a dâk traveller to be detained the best part of a day; and if there was any wind the ferry became dangerous: as for Carts or Troops, their transit was impracticable.

3. In this state of affairs, the Goruckpore Committee determined to run a bund across the valley, with some small bridges and a flying bridge, with pucka pier heads at the Amee. The scheme was considered a very wild one, and impossible, by some; but the existing inconvenience was so great, and the advantage of a good Military road in case of war with Nepal, so evident, that it was resolved to make the attempt, and try what could be done; and the sanction of Government was requested, September 17th 1845. His Honor the Lieutenant Governor in his reply, dated October

15th, 1845, was pleased to "approve and sanction the scheme," and was glad to observe that so great a spirit of enterprize animated the members of the Goruckpore Committee.

4. Thus encouraged, the Committee set to work in earnest. The bund might have been carried straight across the valley and jheel; but it was determined in preference to carry it along the water ridge between the Raptee on one side, and the Amee on the other, in the hope that by thus running it along the natural limit between the two rivers, it would be less likely to be carried away. Were it to be done over again, the Committee would carry the bund straight across; as from the deep and extensive excavations for earth, no trace of the original form of the ground is now visible.

5. It was at first supposed that a height of from 10 to 14 feet would be sufficient; the bund being 40 feet wide at the top, and 60 at bottom, a berm of 30 feet wide being left on each side, between the bottom of the bund and the canals from which the earth was dug.

Season 1845-46.

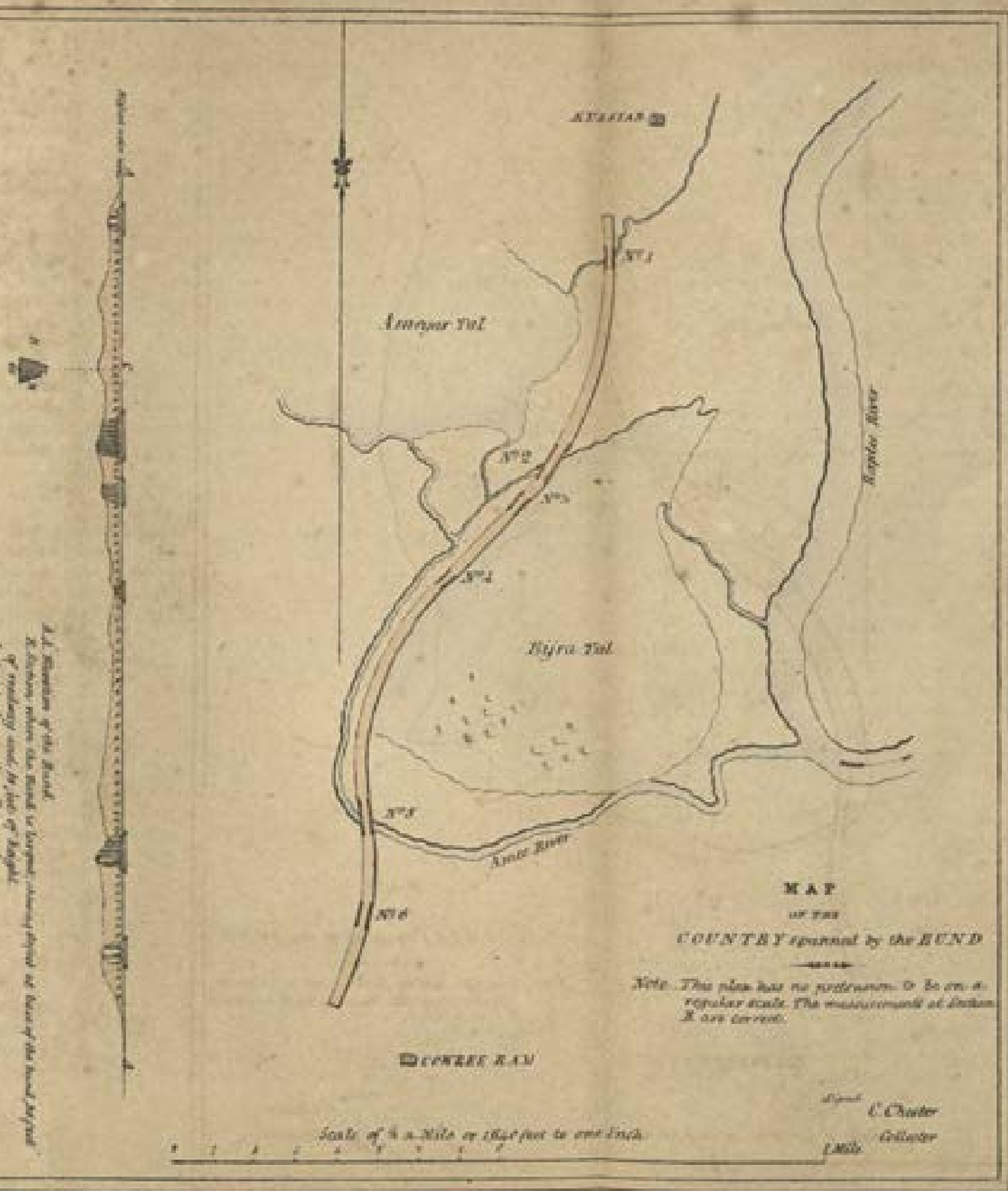
6. The work was commenced by 300 prisoners and large gangs of hired laborers on the 16th October 1845; bricks were made and burnt, lime prepared; and the foundations of the Kussiar and Cowree-Ram bridges, of three arches of 18 feet each, laid on 25th December: those of the five arches, Bijra Bridge, on the 22nd February 1846.

7. Quicksand being found under the Kussiar and Cowree-Ram foundations, they were piled. The Bijra foundations were 12 feet on a layer of kunker well rammed down.

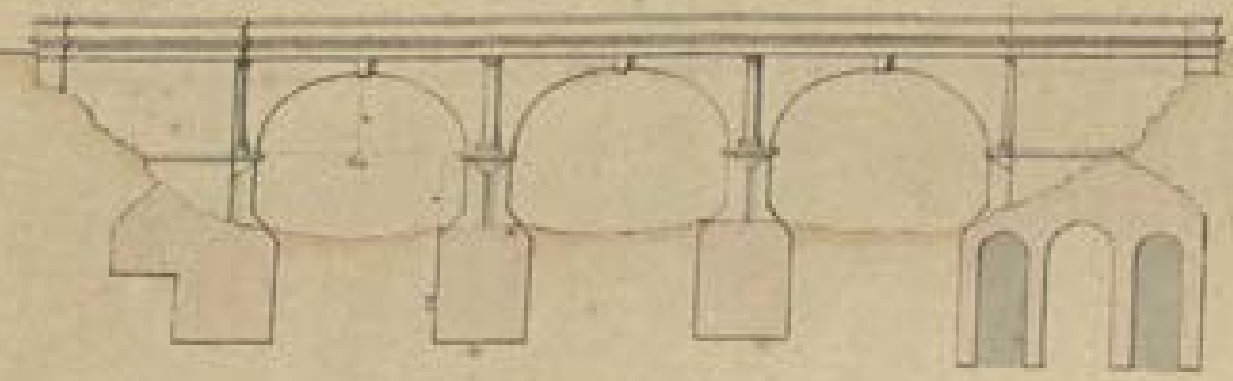
8. The main difficulty was to get tolerable mistrees: Mr. Reade's head-man was dead; and there was no one who had an idea above drain bridges of 12 or 16 feet span. The arches of the Committee's first bridges never therefore exceeded 18 feet. The men, however got bolder in time; and the Committee have just completed an arch of 36 feet span, a very flat ellipse of only 9 feet rise.

9. To get the bricks in these elliptic arches laid true, was another difficulty. In all bund work, a flat arch is better than a semi-circular one; but the mistrees had not an idea how the bricks should be laid, I had therefore to invent a little machine, of which I enclose a sketch, which easily enabled them to lay every brick true.

10. During the hot weather of 1846, the Amee was bunded to clear out water from the foundations of a proposed bridge of 8 arches. In this job much trouble was experienced from springs of water. However by the rains, the foundations of the abutments


RUSSIAN
Amoor Tut
Bijra Tut
Kapile River
Amur River
MAP
OF THE
COUNTRY spanned by the BUND
Note. This plan has no pretension to be on a regular scale. The measurements at bottom are correct.
CONREE RAN
Scale of ½ a Mile or 1848 feet to one Inch.
1 Mile
C. Chester
Collector

N°4.



Numbers 1, 2 and 3 are very similar to this, with the exception that N° 3 has five arches. These arches are elliptical, 24 feet each, with a rise of 9 feet. The ends abutments is upon cylinders.

Signed
R. Garrett Tucker
Collector

If Henry the length of B.C. between the piers of the arch, being attached to the two pins A B, a mould was to be taken on the instrument A, which must be so adjusted that both straps should be equidistant from the central point D. when this is done the pointer A E will give the proper inclination of the brick for every point in the slope.

and 7 piers were laid, and the walls carried up 6 or 8 feet, to let them settle well before turning the arches.

11. The other three bridges were completed, but not plastered, before the rains, so that the bund was practicable, with the exception of the gap at the unfinished bridge over the Amee, until the 27th October, when a very heavy flood occurred which topped the bund, and carried away a great deal of earth in spite of all precautions in raising a ledge on the bund, and protecting the more exposed parts by branches of trees. I stood on the bund when the waters were within a few inches of the top, and the waves of the 8 or 9 cos expanse of waters were beating on the range of leafy branches which had been placed to resist them. It was rather a nervous situation for the amateur architect. The great difficulty was to get earth, which could only be got from the high land at either end of the bund, a mile off, and the attempt had soon to be relinquished, and the bund left to its fate.

Season 1846-47.

12. When the flood cleared away, it was found that two piers and one abutment of the Amee bridge had been completely undermined, the piers thrown flat, and the abutment fairly turned topsy-turvy with the bottom layers of kunker and brick uppermost in the air. This, though disheartening as shewing the wretched soil we had to deal with, was so far satisfactory as proving the substantial manner in which the bricks had been put together. The whole formed one huge mass, which we had exceeding great difficulty in breaking up, as I had no practical knowledge of blasting, and was afraid of blowing up some of my prisoners.

13. The prisoners and laborers were again set to work, and the earthwork of the bund was raised from 2 to 5 feet above its former level.

14. Three new piers were added to the Amee Bridge, and to get out of the way of the insecure foundation of one of the fallen piers, the new one was placed beyond it, so as to make the centre opening 26 feet. These new piers and the new abutment were built on cylinders.

15. A new bridge of 7 arches of 24 feet span was also commenced near the former Bijra one, and 24 cylinders sunk from 15 to 26 feet, and the abutments and piers carried up to the spring of the arches.

16. Another bridge of 3 arches of 24 feet span was also built, and arched over before the rains.

17. It was found that all the Punniar trees which had been planted at the sides of the bund, although they threw out fresh leaves, and gave every appearance of flourishing so long as the

bund remained soaked with water, withered and died as the bund dried up.

18. The rains of 1847 were even heavier than those of 1846, and the floods higher than had ever been known by the oldest inhabitant. On the 7th October, the bund was completely over-topped, the water reaching to the cornices of the bridges, 3 or 4 feet above the crowns of the arches, and carrying away a great deal of earth. However the four completed bridges stood the strain bravely, as also the tall pier walls of the 11 arched Amee bridge, not one of which gave in the least. This was creditable to the masonry; as with such a rush of water and without the supporting thrust of arches, it would not have been wonderful had some of these high pier walls given a little.

Season 1847-48.

19. Guided by this extreme flood, all these piers were raised three feet higher before turning the arches so as to allow full waterway; whilst the central elliptical arch of 26 feet allows of the navigation continuing unimpeded.

20. Of the unfortunate new Bijra bridge, one abutment and two piers, although built on cylinders, were completely rooted up, and upset, the cylinders and piers lying unbroken flat on their sides, and the abutment flung aside in two huge masses; whilst, where part of the bund had stood, there was a deep koond for 250 feet.

Season 1848-49.

21. This was trying. It seemed as if the more pains were taken to lay deep and good foundations, the worse the work was, and of course the feeling spread that the scheme really was impossible, and that the bund could not be finished.

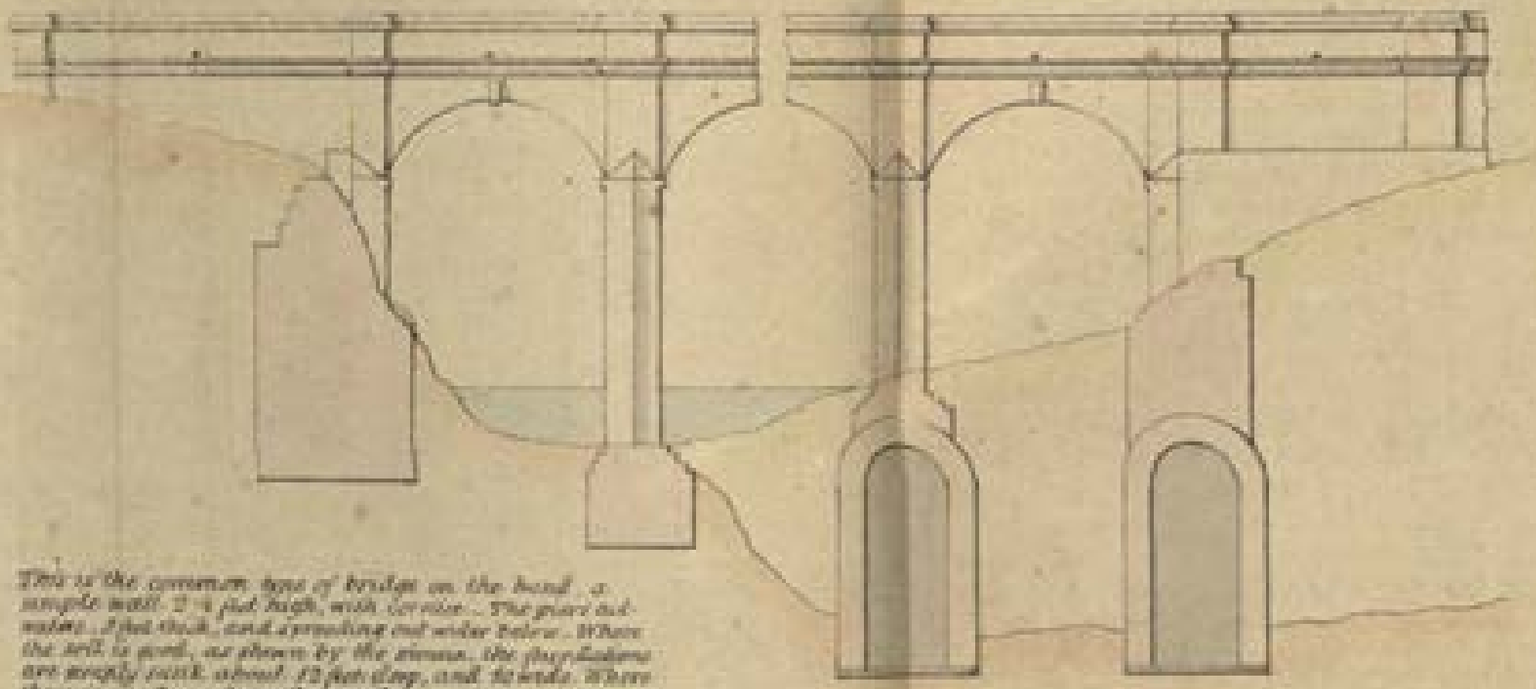
22. The Goruckpore Committee, however, were not disheartened, but determined to bridge the whole koond, which might be supposed to be the extreme waterway required in the severest flood, by a new bridge of 15 arches of 24 feet span each. Syud Hahee Buksh, an old distinguished thanahdar, who had built several bridges in Azimgurh, was called to the work; and by dint of hard work the whole 15 arches were completed, and the bridge and bund made passable from end to end before the rains.

23. The rains of 1849 were happily slight, and all the bridges and bund remained uninjured.

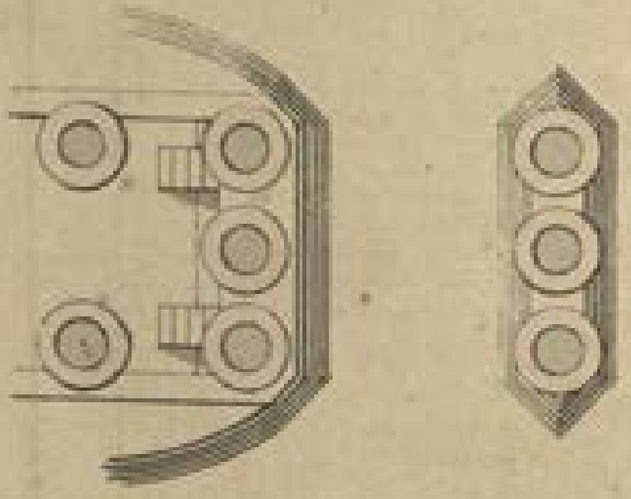
Season 1849-50.

24. The laborers have nearly all been dismissed, and the 300 prisoners are busy in plastering the bridges and in building a connecting wall between the two Bijra bridges. The soil there is so very bad, that the earth will not stand at all, even though the

No 1



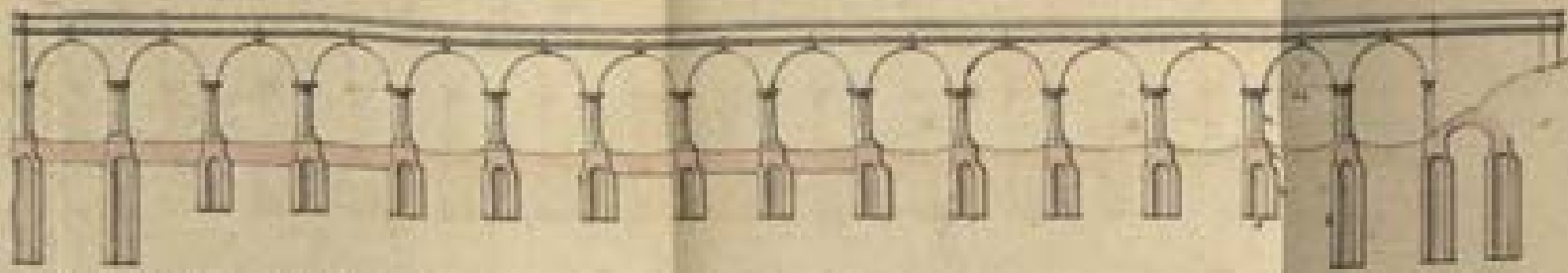
This is the commonest type of bridge on the Inland. A single wall 21 ft high, with corbie. The piers are eleven feet thick, and spreading out wider below. Where the soil is good, as shown by the stones, the foundations are simply resting about 12 feet deep, and 30 wide. Where there is sand, as shown by gimlet, wells have to be sunk. Some of these have to be carried down 35 feet. Some of the parliament below have brought to show especially their chains being cut.



This is our ordinary plan of foundations. 3 cylinders to each pier and 2 to each abutment. Each cylinder is 9 feet in diameter inside with 2 feet wall. The piers are all cut into right angled cutwaters. There are 2 buttresses behind each abutment and sloping buttresses at the sides. Some of the bridges have pipes down the side of the buttress to the water. The roadway is invariably 20 feet, with 2 feet side walls, giving a total breadth of 24 feet. The arches vary from 35 to 70 feet. Where there is any fear the foundations are sealed by a flooring 4 or 5 feet thick.

Signed
H. Carrie Tucker
Collector

Printed at the Inverness Courier Press



This great Ayre bridge has 18 arches of 70 feet span each. The piers are 96 feet high and 9 thick. All are built upon wells, the upper ones 8 = 12 = 20 below ground, the end and abutment wells 8 = 20 = 28 feet below ground. Each cylinder is 9 feet in diameter. Some of the openings are bricked up; as are 10 arches the piers together. The piers are simple cutwaters. The 18th opening there are 2 spans to carry off the main water which falls on the bridge during a thunderstorm, my embankments are sloped and where they join on to the bridge so as to allow the cows where the bridge have no parapet. The total height from the ground to the top of the low parapet is 126 feet. The total waterway 840 feet. The total length of the bridge 1260 feet. The road way is 24 ft wide between the parapets, the bridge itself being 30 feet wide.

Plan of piers and half an arch

The Arrow bridge has 12 arches; the center an ellipse of 80 feet span, the rest semi-circles of 60 feet. Above each pier is a pilaster of 21 feet high, below there is a simple cutwater of 16 feet high. With the exception of 2 piers, the whole is built on wells 8 = 12 = 20 feet deep. 5 of the openings are bricked up below. There is a small one each pilaster. The wing walls extend 80 feet in length, and slope level down to the water. The total height of the bridge from the ground is 76 feet. The waterway 530 feet. The piers having been raised 3 feet higher than was originally intended, the arches spring some distance above the cut water.

Signed

E. Curtis Taylor
Collector

Scale 1 inch = 10 feet

Received in the Secretary's Office, Plan

Committee took merely the upper layer of the neighbouring jheel; and they have been therefore obliged to build a supporting wall to prevent the earth slipping away.

25. The whole of the sides of the bund have been thickly planted with coarse grasses and reeds, and the upper edge with different forest trees which are now getting on nicely.

26. The Committee believe the bund to be now quite safe and sound; but if kunkured, so much the better.

The waterway is as follows:—

1	bridge of	15	arches each	24 feet span	360 waterway.
1	ditto	11	ditto	26 & 18 feet	206
1	ditto	5	ditto	18 feet	90
1	ditto	3	ditto	24 feet	72
2	ditto	3	ditto	18 feet	108
6	ditto	37	ditto		836 feet waterway.

27. The earthwork at present is 13,144 feet, or about 2½ miles long; 20 feet road-way and 80 feet at the bottom with berms of about 20 feet, and the average height is now about 18 feet.

28. About 300 prisoners and 262 hired laborers on an average, have been employed on the work under the superintendence of Moolvee Reza Allee, tuhseeldar, Moozuffer Hoosen, jail darogah, Syud Ilahee Buksh, thanahdar of Amorha, and Ubdool Nubbee, thanahdar of Bunsgaon, to all of whom the Committee feel much indebted for their zealous and gratuitous labors. They deserve to receive the thanks of Government. Soobrattee mistree has also done good service.

29. The expenditure has been as follows:—

Season of	1845-46,	Rs.	17738	14	7
Ditto	1846-47,	„	18140	1	5
Ditto	1847-48,	„	8943	4	11
Ditto	1848-49,	„	17037	12	3
			61860	1	2
Ditto	1849-50, to this time,		6704	15	8
	Total,		68595	0	10

30. One main result of the Committee's experience is this, that in Goruckpore, it is best to build bridges on the upper crust, without any foundation. Wherever particular pains have been taken to sink good and deep foundations, there the misfortunes have always been greatest, whilst adjoining bridges without any foundation have stood firm.

31. The most gratifying result, however, has been the unusual mark of the approbation and confidence of Government in the spontaneous grant of Rs. 30,000, to assist the Committee in carrying on their public works.

32. In closing their report on the Cowree-Ram bund, the Committee cannot but again call the attention of Government to the impolicy of tying the legs of the Executive Engineers to their desks, instead of having accountants to examine and keep the accounts, and leaving the Engineers free to run about their divisions and give their most valuable aid to the Local Committees. This Committee, with the exception of a slight sketch of a bridge, has received no assistance whatever from the trained Engineers of Government, and has consequently had to feel its way as it best could. It is absurd that large and important works should be left to mere amateurs, whilst the Engineers, who could direct them skilfully, are confined to mere desk-work, and allowed to remain almost useless. The present Barrack Master system is utterly bad; and the sooner it is mended the better. Till then even with the very best intentions, Magistrates and Committees must waste much money in experimenting. They do not pretend to Engineering skill, and all they can do is to do their best.

I have, &c.,

H. C. TUCKER,

Magistrate and Secretary,

One per cent. Road Fund.

P. S.—I have been examining the bund and jheel to-day, and it appears very clear that the jheel to the westward is rapidly silting up. In a few years the canal on that side will be filled up and the lands raised several feet. This will be a new protection to the bund, and may prevent the Raptee coming this way.

It may be useful, perhaps to remark, that none of the Committee's bridges cut their bunds, as is so frequently the case elsewhere. The reason is that two spouts are allowed to each arch, so that all the rain water which falls on the bridge flows off by the spouts, instead of draining off to where the bridge is attached to its embankment, and cutting the embankment off: thus leading to the common sight of a fine bridge standing detached by itself, its embankment cut, and no means of getting to the bridge, travellers quietly wading through the water below it. Mr. Bird's Chitaee bridge requires these spouts; half the embankment being regularly washed away every year by the rain water from the bridge.

H. C. TUCKER.

S E P A L
A L I P U R E
D I S T R I C T

No. V.—Minute by E. A. Reade, Esq. C., S., *Commissioner* of the Benares Division, on the subject of the roads in the Goruckpore district, *dated* 23*rd February* 1850.

Review of the subject *ab initio*.

1. The subject of the roads in this district having recently elicited comments, it will be useful to take a review of past operations, and the principles which guided them from the first establishment of the fund to the present time.

State of the district communications prior to the settlement.

2. The communications of the country prior to the settlement; and I speak from experience extending back upwards of 20 years, were little better than cart tracks. The Muhajun's bridge over the Teraina between Cowree-Ram and Gola Gopalpoor was the only bridge, except the small Towee-ka-pool, over a nullah between the north and south parts of the town of Goruckpore, which existed, before the cession of the district, as the indications of former enterprize. No bridge has ever yet been built by the Executive Engineer in this district, though our tenure of it has approached to half a century, and it was not till 1821 that Mr. R. M. Bird first set the example of constructing bridges over running streams. The bridges over the Sowabowee, the Amee and the Teraina, besides those in the south of Goruckpore, remain lasting memorials of his energy and abilities. He restricted his attention to the valley of the Raptee and the Gogra, evidently because the principal commerce of the country passed to it to and fro of the productive portions of this district, and those south of the Gogra.

First measures since the establishment of the Fund. The Hurveylee Forest.

3. As the survey of the district proceeded, and the assessment increased also, it became manifest that the future capability of the former to meet the pressure of the latter depended on the extension of commercial intercourse, and the use of roads and rivers. It was of the first importance that cart tracks should be made thoroughfares to the main river of the district, the Gogra, or elsewhere recognized as roads, to prevent appropriation of the land; and this was easily accomplished.* But the barrier between the fertile parts of the district east and west, the Hurveylee forest running up diagonally to the Terai was the difficulty to be overcome. The first exertions made were to pierce this obstacle at several points in longitude as well as

* It was reasonably supposed, that by making cart tracks to any river good roads, bazars would spring up at the terminus. In most cases, experience has shewn the correctness of the anticipation.

latitude. Roads Nos. III., V., VI., VII., XVIII., XXXII. and XXXVII. were thus opened through heavy jungle.

4. The next step was to classify the communications of the district. The settlement was completed, and thus enabled them to be classed pretty accurately according to their relative importance. Three classes were established,—1st, of main Military and Post roads,—2nd, of Commercial roads,—3rd, of Byé roads.* Experience has shown that the estimate thus formed of each road has not, during the course of events in the last ten years, been affected so as to render a reclassification necessary.

Next classification of roads.

5. My original design was that the surveyor should lay down new lines of road through the pergunnah allotted him for survey, preparatory to correction of the sinuosities in almost every road, which had been made simply by conversion of a cart track into a thoroughfare; but the surveyors were required elsewhere and were hurried off. With the exception of Lieutenant Lawrence little aid was rendered by any, and frequent applications to the Sudder Board for the services of an assistant Surveyor and the necessary instruments, only received the reply that neither could be spared. Mr. DeSilva was at length deputed to the district, and some partial reforms were effected with his aid. It may be remarked as a general observation that though the lines of communication have been fixed, the process of abbreviation by correction of sinuosities is still a desideratum. This remark does not apply to the new lines cut through the forest.

Original design for improvement of roads how frustrated.

6. Before systematically undertaking this improvement, it appeared to be more a matter of necessity to complete a series of latitudinal parallels east and west of the district. Southward there existed first, the road from the little Gunduck on the left bank of the Gogra to Fyzabad; second, from Samere Bhagahuttee through Goruckpore to the same point. Northward, in adherence to this principle, the junction between the Gunduck and the Raptee, or Perrowna and Mhendawul was first effected; and subsequently a line was opened from Boggah through Goortee ghat on the little Gunduck, and Subeya, to the Dhumaila: but the line between that point and Bansee is still incomplete. A design to extend the line of road, along the Nepaul pillars on the north face of pergunnah Bansee through the intruding portion of the Nepaul territory and along the line of the frontier to the great Gunduck, was abandoned, the nature of the country and the impracticability of boats navigating

Latitudinal parallels.

* 1st class roads, 50 to 40 feet wide,—2nd class, 30 to 40,—3rd class, 20 the minimum.

so far up that river, owing to the force of the stream and the quantity of trees imbedded in the channel, being conclusive arguments against the success of the project.

Principles adhered to by Committee.

7. The principles which regulated proceedings while these measures were in contemplation and progressing may be briefly stated: 1st; the future operations of the season were determined at an annual meeting of the Committee. 2nd; main roads were annually put in good repair; commercial roads received ordinary mending annually, and were repaired effectually once in three years: bye-roads were kept passable annually, and a discretion was left with the Superintendent to repair them effectually as he deemed necessary. 3rd; savings were annually accumulated for the purpose of building bridges on a scale which required the aid of professional experience. 4th; members of Committee were elected from residents in the interior of the district, whose advice, suggestions and reports were made the subject of resolutions of the Committee at their annual meeting, or at special meetings when such was deemed necessary. 5th; the tehseeldars were directed to report to the Collector on the state of each road in his jurisdiction, and in some cases were necessarily charged with the duty of superintending the necessary repairs; but the system of contracts was preferred.

Savings made annually for the purpose of bridges.

8. In several places, embankments as approaches to bridges were raised, and bricks made and burnt for the latter elsewhere. In some instances bridges also were completed, but as I do not pretend to be an Engineer, I deemed it right to abstain from entering upon any very extensive work, and better policy to incur a small annual charge for temporary bridges, and steadily to accumulate the funds necessary for the erection of suitable permanent structures of this description. I was thus enabled to place a sum of Rs. 50,000 at the disposal of my successor in office.

Several good bridges built.

9. During the last five years the contributions to the register of bridges, which it is one of the laws of the Committee to keep up and revise annually, have been numerous and important. Whatever may be the difference of opinion regarding the chief work to which Mr. Tucker has applied his mind and energies, its comparative utility or prospective durability, the number of excellent bridges erected by him in other parts of the district, are more than sufficient memorabilia of his usefulness. The district roads doubtless are not in such order as could be desired, but at least they are practicable, the commerce of the country is not impeded, the thoroughfares have not been absorbed. The restoration of a road,

at least in this district, is a simple matter, but the construction of a large bridge requires experience and talent of a particular order. Mr. Tucker will have made a good use of time, and money, even if his greatest undertaking proves a failure, and I do not think this district can be better cared for in after years than by alternate changes in the executive, of officers content to make good roads, and capable and willing to build good bridges.

Suggestions in the matter of roads.

10. It will probably be deemed advisable to give the benefit of the annual income, now in course of realization, to the effectual repair of the roads, and a few suggestions, the result of experience and observation, may be useful. In several parts of the road, where the soil is light, the road is now below the level of the country. Besides the scrapings from the kennel, earth must be added, and this should not be taken from the fields as is too often the case, but from a trench three or four feet wide on one side of the road. The depth of the trench will be in proportion to the quantity of earth required. There should be a small margin between the trench and the kennel of the road. If the excavation of this trench be even, it will be useful to the owner of the field for future irrigation. This *modus operandi* was tried on the Pipraitch road between Puttrah and the forest, and answered well. In dhoos or pure arenaceous soils, accumulation of it on the road is only an aggravation of evil. These tracts are usually not extensive, and in such places the road should have a superstratum of firmer soil, or be metalled, if *kunkur* can be obtained. Generally in this district grass should not be separated from the top dressing, as it binds the soil, and enables it to resist the action of high winds. In the terai portions of the district, it is a most grievous mistake to remove the sod. The only repair these roads ordinarily require is to fill in the indentation of the backery wheel with turf; in renewing approaches to bridges it is a prudent precaution to maintain a slope from the bridge downwards to the commencement of the approach. In cases of excessive inundation, the surplus waters thus find a way of escape, and the safety of the bridge is ensured.

Correction of sinuosities. Procedure recommended.

11. The desideratum, as I have above stated, is the correction of sinuosities in the principal thoroughfares. The people have long been prepared for this improvement, and will generally be found very reasonable. In correcting a circuit as the roads are universally wide, one thing is certain that the area of the old will always exceed that of the new cut; years ago when this subject was discussed with a native Committee of land owners, their remark was, that the tenure of land hard by a crooked road was never safe, the road would sooner or later be straightened, and therefore

the sooner done the better. If these precautions were taken there would not only be no grievance, but the owner of fields on the new line would often be a gainer: 1st, the line to be laid down in the dry months when the crops were off the ground; 2ndly, the line taken to be made the next year, or rent paid for it if deferred; 3rdly, the old road to be measured, and divided amongst those whose fields were taken up all or in part by the new line; lastly, that the line be marked off either by the Collector or by a Surveyor with a theodolite. In this way the most circuitous road in the district from Barhul to Bhowapar was made straight without a single complaint, and it was admitted in many instances that the old road was more productive to the cultivator than his former land. If a standing crop must be cut down, there is one and but one way of settling the question of compensation, viz. by a summary punchayet on the spot and cash paid down.

12. I think the road No. V. might be first subjected to this improvement with advantage, being I think about the most crooked of the main roads, and where the alteration is likely to be hailed with satisfaction, and would serve as a precedent for others, that of No. VIII. being now of long date and forgotten. On the same road, if practicable, I suggest the construction of a bridge over the Môn Nuddee, the bricks for which were burnt six years ago.

Main road No. V.

13. Of commercial roads one only appears to require a suggestion from me. No. XVI. is the great commercial road of the district; and for the safety of Mr. Bird's bridges upon it, inspection and effectual repair appear to be necessary.

Commercial road No. XVI.

14. Of other roads too I need only also note one. It would be as well to complete the northernmost parallel from the Dhumaila to Bansee, and to construct a bridge of masonry pier, and saul timber platform over the Powye Nuddee at the point where the parallel and the main road No. III. cross each other.

Northern parallel what is required.

15. To the above suggestions I would add others connected with bridges in this district. Mr. Tucker recently pointed out the advantage of furnishing bridges built by his predecessors with spouts through the parapet walls to carry off rain falling on the bridge, which, as he observes, otherwise makes rifts in the earthen approaches. In the jungle and terai it will be safer to lay platforms of saul beams, cross-pieces, chylas, earth and kunkur over all, on masonry piers, built up on jainowots or curbs of jamun wood (which does not rot in moisture) than to build

Suggestions in the matter of bridges.

arched bridges. The small brick called the Lakhowree is better suited for bridge piers than the large brick used in other buildings. Every notable bridge in the district should be inspected and reported upon by some competent person at least once a year.

CAMP BURHULGUNGE :
The 23rd February, 1850. }

E. A. READE,
Commissioner, Benares Division.

MEMORANDUM—BRIDGES IN THE GORUCKPOOR DISTRICT.

No.			Arches	Value	
1	Sohun Lall, a Muhajon of Benares,	Teraina,	9	10000	10000
2	R. M. Bird,	Amee Nuddee,	7	6000	
3		Sowa Bhowa,	3	4000	
4		Teraina,	3	3000	
5		Great Mukuneya,	3	3500	
6		Toorkmanpoor,	3	1600	
7		Burial Ground,	1	1600	19700
8	J. Armstrong,	East of Cantonments,	3	2800	2800
9	E. Currie,	Towees Pool,	1	650	
10	Ditto,	Captainguinge,	3	2500	1350
11	E. A. Reade,	Little Mukuneya and Busseadeeh,	4	3700	
12		Goreya Bagh,	3	1600	
13		Toorna Nuddee,	3	1550	
14		Silhenee ditto,	3	1500	
15		Teraina,	3	2191	10341
16	H. C. Tucker,	Jhurrye Nuddee,	3	3000	
17		Toora ditto,	3	1425	
18		Furreend ditto,	3	1865	
19		Saeginwah,	2	1803	
20		Amee,	9	11826	
21		Khuleelabad,	1	606	
22		Khood Nallah,	1	1113	
23		Kutnya,	3	2363	
24		Oorwara,	2	936	
25		Khajera,	1	625	
26		Muchooe Nallah,	3	1220	
27		Muwsarana,	5	6300	
28		Goorgahwa,	1	772	
29		Ramrekha,	3	3493	
30		Boornya,	3	1359	
31		Kwana,	5	21000	
32		*Cowree-Ram.*			
33		One Bridge,	15		
39		One ditto,	11	81547	
		One ditto,	5		
		Four ditto,	3		
40		Dalduha,	3	6000	
41		Toora Nuddee,	5	4000	
42		Furhein,	6	6000	157833
		Grand Total,			203824

E. A. READE, *Commissioner.*

No. XLVIII.

CHOWKEEDAREE ASSESSMENT IN SHAHJEHANPORE.

Letter No. 26 *of* 1850, *from* FREDERICK POLE BULLER, Esq., C. S., Magistrate of Shahjehanpore, *to* HENRY PIDCOCK, Esq., C. S., Commissioner of Rohilcund, *reporting the* Chowkeedaree Assessment *of the District.*

Sir,

I have the honor to report the result of the introduction into the city of Shahjehanpore of a chowkeedaree assessment under the provisions of Regulations XXII. of 1816, and XV. of 1837.

2. These enactments not having been originally brought into operation, seems to have been owing to the peculiar division of the city into mohullehs, over each of which a Mullick or chief presides, in whom the appointment of chowkeedars was vested. These Mullicks, when the city was founded by Buhadoor Khan, were the heads of various tribes of Afghans, who obtained separate grants of land from the Nuwab, and inducing their relations and dependants to build in their neighbourhood, thus gradually formed a number of mohullehs, which eventually became the present city. But they never themselves paid, nor called on any person of their own tribe to pay for the chowkeedars they appointed to guard their mohullehs: whose salaries therefore, according to lists prepared by the Mullicks, it fell on the artizans and laboring classes inhabiting the spot to defray.

3. Under the British rule, however, the Mullicks gradually have lost their influence, and the payers learnt to evade payment of the chowkeedaree dues. The character of the chowkeedars sunk in proportion with the irregularity in the collection of their salaries. In 1838, the average wages paid to 126 chowkeedars was one rupee eight annas, the highest being two rupees eight annas, and the lowest eight annas, or Rs. 189 per mensem in all. An attempt was made in this year by Mr. E. C. Monckton the Joint Magistrate, to raise the salaries to the general standard of 3 rupees.

This increased the chowkeedars' wages to Rs. 378. An overseer also on four rupees was appointed to every five mohullehs, and a jemadar over all on 6 rupees. This establishment cost Rs. 74, which added to Rs. 378, made the total chowkeedaree payments Rs. 452. This sum was collected from the 20th May 1838, to 4th March 1839, when the tax was felt intolerable; it having been left to the Mullicks to assess the contributors, who of course w[illegible] those least able to afford it. The rate was therefore reduced to 2 rupees per chowkeedar, without any extra establishment, which diminished the total payments to Rs. 252.

4. Thus matters remained, though the necessity of making some revision in the chowkeedaree arrangements continually forced itself upon the notice of the authorities. At length in June 1848, it was proposed to call for a statement embracing such information regarding the names, profession, and circumstances of each householder in the city, with the number of houses, and their condition, as would serve as a ground work for the introduction of a general assessment according to the regulations of Government.

5. The preparation of this statement was left to a trustworthy person appointed for the purpose, under the superintendence of a Sudder Committee composed of the individuals as per margin.* The work also as it progressed was frequently tested by Mr. Barnes in person.

* Fida Alee, Deputy Collector under Regulation IX. of 1833,—*President*.

Nizam Alee Khan, tuhseeldar of Shahjehanpore,
Nungoo Lall and Ram Gholam, Muhajuns.
Nasir Khan, Khun Suree.

6. In October 1848, the registration of the houses being completed, 155 persons forming 31 punchayets, being 5 persons to each, were nominated to determine the assessment on each house or cluster of houses forming the property of the same individual. As the mohullehs were 94 in number, and many of them close to each other, it was considered preferable to appoint a less number of punchayets than one to each mohulleh. An inhabitant however of each mohulleh was always invited to each punchayet. I may here observe that the Mullicks had previously in a body come forward and signed a paper, resigning into the hands of Government all further claim to the right of appointing chowkeedars, from which they derived no advantage. They declared that their authority in their mohullehs was only partial, that they had little power to coerce bad characters, and it was therefore hard to exact from them the duties of zumeendars, and impose on them the penalties of non-fulfilment of those duties; still they were willing as individuals of consideration, and as members of the punchayets to assist the Government in appointing chowkeedars, and determining the assessment, &c.

7. On the 16th February 1849, the lists of the persons assessed were forwarded by the mohulleh punchayets to the President of the Sudder Committee, by whom they were returned with orders for the members of the Committee to look over the assessment, which they had hitherto omitted to do, and after making at alterations their local experience might suggest as proper, to rn the papers after signing them.

8. This being done on the 2nd June 1849, the papers were submitted for the sanction of the Magistrate, by whom the 9th of June was fixed for hearing in open kuchehree any petitions which might be offered against the assessment. As however for many years previous, and during the last year when the registration of houses and lists of assessment were being made, the minds of the people were fully prepared for the measure, it was not deemed necessary to stay the collection of the tax. An order therefore was passed, for copies of the lists of assessment at once to be stuck up, for the information of the people, in the kotwalee, and in each mohulleh, and for the enforcement of the collection of the tax from the 1st of the following month (July).

9. Meanwhile on the day appointed 600 petitions, bearing the signature of 1190 persons, had been presented. The following is an abstract of their purport.

Praying for total exemption from the tax, ..	301	petitions.
For reduction in the assessment, ...	232	„
For information regarding the tax imposed,	64	„

Three petitions remain, the donors of two of which declared they gave them because others did so. The third contained no special complaint, but alluded generally to the heaviness of the chowkeedaree assessment. Of the petitioners, 464 were not forthcoming on their names being called over, nor did they attend afterwards, though invited to do so through the kotwal of the city; 726 persons attended in 452 cases; of these 24 were struck out, the parties objecting to be examined on oath; 46 ditto, the parties not appearing to be taxed at all. In 95 cases, the petitioners on hearing the sum assessed on them, departed contentedly; 161 petitions were rejected, the circumstances and ability to pay of the parties being considered notorious. There remain 126 requiring report.

10. By a summary comparison also of the registers of houses, in which the circumstances of the owners were detailed, with the lists of assessment prepared by the mohulleh punchayets, discrepancies in 330 cases were apparent, viz. in the former, 182 numbers were represented calling for assessment, which in the latter had been exempted; 53 numbers seemed capable of a high assessment, which in the latter were assessed at a low rate; 55 numbers seemed worthy of exemption, which in the latter had been

assessed; 21 numbers called for a lower rate than had been assessed in the latter: and the houses in two numbers were declared to be empty, which in the latter were occupied. In both statements the circumstances of 17 numbers were described alike, but the assessment was unequal.

11. From the above enquiries, it appeared to me that much yet remained to be done to make the assessment complete and even. Indeed from private sources, I was informed, that the mohulleh punchayets thinking the task an invidious one, to tax so many people whom they had before exempted, and dreading personal collision with them, had drawn up their lists as much in private as possible. It did not follow that they had prepared them less carefully, or in applying the rates, had neglected to carry out to the full the orders they had received; but opportunity was not given to people to make their objections, which if they did not hear, the punchayet laid themselves open to charges of partiality or enmity. The Sudder Committee also had held no public meetings, and the alterations which they had made in the assessment, though considerable, had still been rather the result of their personal knowledge of the parties concerned, than of enquiry. Finally, it was always my intention to allow a year to elapse from the commencement of the collections, before submitting the chowkeedaree arrangements for sanction.

12. On the 13th July 1849 therefore the Sudder Committee were desired to revise the entire assessment. This has now been done, and on the 6th of last month, the papers were returned by the Committee through the President. In the interim 13 meetings, lasting one or two days each, have been held in the most public places in the city. In these the assessment of 50 mohullehs was revised. Other meetings were held in the tuhseeldaree kuchehree. Others the mohulleh punchayets were directed to hold. These meetings were duly advertized beforehand, and all who chose, encouraged to attend them. The rates leviable from each individual were then called over in turn, and when any objections were offered, the case was disposed of on the spot, or set apart for further enquiry. Numberless objections were heard by the Committee of their own authority. The 600 petitions also alluded to in para. 9, which had been presented to the Magistrate, although they had been disposed of by him, yet for cautions' sake, with 74 new ones, were made over to the Committee in one lot. Of the whole, 385 were rejected; 167 were found to justify interference; in 54 cases, the parties were found to be already exempted from taxation: and in 68, the identity of the petitioners was not traced.

13. The following statements (Nos. I. II. III.) will shew the result of the late proceedings.

No. I.—Statement shewing the total number of houses assessed and exempted, with the amount of assessment previous to, and since the introduction of Regulations XXII. of 1816, and XV. of 1837, in the City of Shahjehanpoor.

	No. of Mohulleks.	Exempted.			Assessed.			Total.			Amount of Tax.	No. of Chowkeedars.
		No.*	Houses.	Shops.	No.	Houses.	Shops.	No.	Houses.	Shops.		
Assessment in the time of the Mullicks, ...	94	3212	3168	263	7841	8411	1242	11053	11578	1505	243 2 7	123
Assessment of 1849, ...	0	4500	4924	109	6553	6655	1396				879 4 0	202 exclusive of Inspectors, &c.
Do. of 1850, ...	0	4728	5117	150	6325	6462	1355				851 10 0	

* By number is meant single houses, or clusters of houses, the property of the same person, or single houses, though inhabited by several persons.

No. II.—Statement shewing the alterations in the Assessment of the Mullicks, which were made in 1849.

Before and still Exempted.			*Before Exempted and now Assessed.*				*Before and still Assessed.*						*Before Assessed and now Exempted.*			
Number.	Houses.	Shops.	Number.	Houses.	Shops.	Amount of tax.	Number.	Houses.	Shops.	Former tax.	Present tax.	Increase.	Number.	Houses.	Shops.	Amount of tax.
2100	2296	59	1112	1072	188	127 15 3	5441	5583	1208	195 8 4	751 4 9	555 12 5	2400	2628	50	47 10 3

No. III.—*Statement shewing the alterations in the assessment of* 1849 *which were made in* 1850.

Cases in which the former arrangements continue undisturbed.							*Increase.*												*Decrease.*											
Unassessed.			Assessed.				Increase on former Assessment.					Newly Assessed.			Total.				Decrease on former Assessment.					Exempted from former Assessment.				Total.			
Number.	Houses.	Shops.	Number.	Houses.	Shops.	Amount of tax.	Number.	Houses.	Shops.	Former tax.	Present tax.	Increase.	Number.	Houses.	Shops.	Amount of tax.	Number.	Houses.	Shops.	Amount of tax.	Number.	Houses.	Shops.	Former tax.	Present tax.	Decrease.	Number.	Houses.	Shops.	Amount of tax.	Number.	Houses.	Shops.	Amount of tax.
						rs a p				rs a p	rs a p	rs a p				rs a p				as a p				rs a p	rs a p	rs a p				rs a p				rs a p
4168	4561	93	5405	5438	1186	786 5 9	188	229	38	49 2 9	87 15 0	38 12 3	332	368	4	26 8 0	520	592	42	65 4 3	400	432	127	156 12 3	102 13 6	58 14 9	560	586	45	381 5 6	60	98	172	92 14 3

14. It thus appears that 6462 houses and 1355 shops have been taxed, while 5117 houses and 150 shops have been exempted; 1072 houses and 188 shops have been newly assessed, and 2628 houses and 50 shops, which formerly paid, have now been exempted from assessment; no person being taxed less than one anna. The increase in the tax paid in the time of the Mullicks is Rs. 851-10—243-2-7 = 608-7-5; the total increase on the houses formerly assessed being Rs. 495, and on newly assessed ones being Rs. 113-7-5: while the decrease on houses formerly assessed is Rs. 50-10-3. In the time of the Mullicks, a chowkeedar existed to 106 houses. One has now charge of 70 houses. Add 11 inspectors, corresponding in number with the Police Stations,* and beats in the city, who have been appointed as Overseers of the chowkeedars.

* *Police Stations.*	
Buhadur Gunj,	Kotwalee,
Julalnuggur,	Pakur,
Mudur Khel,	Futtehpore,
Hudduff,	Surai Kuiyon,
Beree,	Azeez Gunj.
Abdoollah Gunj,	

15. The annexed statement (No. IV.) will shew the different rates paid by the people.

Government servants are taxed at the rate of one rupee per cent. on their salaries. Thus a person on 4 rupees a month, if he possesses no other means of support, is exempted; so is a holder of maafee land, if its annual rent be under Rs. 50. If it exceed that standard, he is assessed at one anna per mensem. The highest tax (two rupees) is levied only from people worth Rs. 10,000 in property, exclusive of houses and personal effects. A person worth Rs. 5,000 is taxed one rupee, and so on at this rate. Those, whose only property is their malgoozaree, are assessed at half an anna per cent. on their jumas up to Rs. 500, and one anna, if the juma exceeds that sum. It was found so difficult to assess shopkeepers and artizans by classes or trades, that their individual circumstances only have been considered. Families left without resources or regular remittances, of men employed on Government or other service at a distance, are exempted altogether from taxation.

16. The next Statement No. V. shews the collections,—balances, recoverable, or otherwise,—and the sum remaining in deposit at the end of the year.

No. IV.—Statement shewing the results of different rates levied.

	1 Anna.	1 Anna 6 pie.	2 Annas.	2 Annas 6 pie.	3 Annas.	3 Annas 6 pie.	4 Annas.	4 Annas 6 pie.	5 Annas.	6 Annas.	7 Annas.	8 Annas.	9 Annas.	10 Annas.	11 Annas.	12 Annas.	13 Annas.	14 Annas.	15 Annas.	1 Rupee.	1 Rupee and 2 annas.	1 Rupee and 4 annas.	1 Rupee and 5 annas.	1 Rupee and 6 annas.	1 Rupee and 8 annas.	1 Rupee and 9 annas.	1 Rupee and 10 annas.	1 Rupee and 11 annas.	2 Rupees.	Number assessed.	Amount of tax.
Assessment of 1849,	1165	45	142	1	7	249	1	255	1	35	18	191	4	7	2	16	0	5	1	95	1	0	1	0	18	1	0	0	45	655	3	679	4	0
Ditto of 1850,	1211	22	126	4	0	222	0	222	0	38	50	53	5	11	2	12	2	5	0	90	3	4	1	1	15	2	4	2	2	632	5	851	10	0
Increase, ..	46	0	0	0	0	0	0	0	3	2	4	0	1	4	0	0	2	0	0	0	0	2	0	1	0	1	4	2	2	0	0	0	0	0
Decrease, ..	0	21	15	7	15	27	1	33	1	0	0	0	8	0	0	0	4	0	0	1	5	0	0	0	3	0	0	0	0	23	8	27	10	0

No. V.—Statement of Collections, Arrears, Expenditure, and Cash Balance.

Zillah.	Total assessment from June 1849 to end of May 1850.	Arrears.			Total Collections.	Deduct Expended.			Cash Balance.		
		Recoverable.	Irrecoverable.	Total.		Pay of Establishment.	Miscellaneous.	Total.	Deposit in Treasury.	Surplus Collections.	Total.
Shajehanpoor, ...	10566 13 0	19 7 0	246 2 9	265 9 9	10301 3 3	8315 10 7	176 7 9	8492 2 4	1809 0 11	2 5 7	1811 6 6

Remarks.—The irrecoverable balances are chiefly nominal, the parties being deceased, or having left the city, or their conditions having undergone a change.

The Miscellaneous expences are chiefly on account of stationery, and mohurrirs for drawing up the registration of houses, lists of assessment, maps of mohullehs, &c.

17. The nominal establishment of chowkeedars is as follows:

			Rs. A.	
	70 Men @ 2-8 each per mensem,		175 0	
	72 Men @ 3-0 ditto,		216 0	
	60 Men @ 3-8 ditto,		210 0	
Total Chowkeedars,..	202	Total Salary,...		601 0
	Add 11 Inspectors @ 5 Rs. each,		55 0	
	20 Sweepers @ 2 Rs., including a Jemadar or headman @ 2 Rs. 8 annas for cleaning the city,..		40 8	
* *Note.*—Any money saved in Bhistee's wages in the rains will be expended in extra Bhistees during the hot weather.	15 Bhistees* @ 3 Rs., including a Jemadar @ 3 Rs. 8 annas for watering the main road of the city,.....		45 8	
				141 0
† Buxshee, ... 30	Add Sudder† Establishment,....			67 0
Sayer Khurch, ... 4				
1 Mohurrir, ... 10	Total Monthly Expenditure, ...			809 0
2 Mududgurs 5 & 4=9	Add Surplus Collections, ...			70 4
Peon,..... 3				
Dufturee, ... 3		Total Monthly Collections.,	Rs.	879 4
Mohurrir in charge of Treasurer's Accounts, ... 4				
Do. Sudder Papers, 4				

18. But the full salaries have not been expended, as the collections were commenced from June 1849, and the chowkeedars were not appointed till July; and then only a reduced number, none of whom obtained a higher pay than two rupees, till the complement was made up, and fully organized. Sweepers and bhistees also were not at once obtainable. For these reasons, a greater surplus has accumulated in the present year than is likely to remain in future. It is proposed with this money to construct an office for the Buxshee and his establishment, and pucka chowkees, where also the chowkeedaree inspectors will reside, at the 11 police stations in the city. Hereafter the surplus collections will be devoted to the improvement of the town.

19. I have taken some pains to detail the mode in which the revision of the chowkeedaree assessment was introduced in Shahjehanpoor, and carried out, that it may appear that the proceedings of the authorities have not been hurried. The people have submitted to the measure with cheerfulness, and no sort of opposition has throughout been displayed. Only two petitions from individuals among a population of 62,785 souls have been presented to your office. These are separately reported on. In the absence of any but trifling balances, also, I must conclude that the assess-

ment has been equitably distributed by the mohulleh punchayets and Sudder Committee, and to these bodies my acknowledgments are due for their trouble and exertions in preparing the rates. Alterations from time to time will of course have to be made in the assessment, to adjust which will be the duty of the mohulleh punchayets and Sudder Committee, through whom, as being more agreeable to the people, it is still proposed to work. For this purpose six-monthly sittings will continue to be held.

20. My warmest thanks also are due to Mr. Barnes for his ready co-operation with me in enforcing Regulation XXII. of 1816 in this city, which is one of the first subjects I proposed to him on his joining the station. It is chiefly through his zeal and energy that the preliminary registration of houses by the tehseeldar of Shahjehanpoor and the individual alluded to in paragraph 5, who was afterwards appointed Buxshee, was effected, and the subsequent assessment facilitated.

21. The police has been found to work well in the past year; the principal thefts having taken place in the daytime,—instead of at night, which would shew a want of vigilance in the chowkeedaree establishment. A year's test is perhaps too soon to shew what has been done; but the best results may be expected from the Mullicks being absolved from a nominal and doubtful responsibility, and from the appointment, in the room of the old chowkeedars, who were composed of the dregs of the people, of an efficient and well armed body of men, who with the Regular police will alone be answerable in future for the safety of the city. The situation of a chowkeedar is now worth having, and therefore not lightly to be lost. Self-interest therefore is likely to keep the chowkeedars from their former low courses.

22. The success attending the revision of the chowkeedaree arrangements in Shahjehanpoor, has induced Mr. Barnes to attempt to improve those in other large towns in the district; not by enforcing the authority of Government, but by persuading the people to come forward of their own accord, and make the required revision, assessing themselves by punchayet, &c. The following (Statement No. VI.) is the result of these operations, (for which Mr. Barnes deserves the sole credit,) which are likely to be attended with its happiest effects.

No. VI.—Statement of self-assessed Towns, in Zillah Shahjehanpoor.

Name of Town.	No. of Residents.	No. of Houses.	Not taxed.	Amount of Tax. Former.	Amount of Tax. Present.	No. of Chowkeedars. Former.	No. of Chowkeedars. Present.
Tilhur, ...	13651	2210	521	62 9 7½	141 4 0	35 0 0	44 0 0
Julalabad, ...	4689	971	84	12 10 9	61 13 7½	12 0 0	15 0 0
Kuttura, ...	3643	612	95	19 12 6	41 0 0	6 0 0	11 0 0
Khodagunj, ...	4841	921	74	28 1 4½	72 0 0	14 0 0	19 0 0
Total, ..	26824	4714	774	123 2 3	316 1 7½	67 0 0	89 0 0

I have &c.,

(Signed) F. P. BULLER,

Magistrate.

SHAHJEHANPOOR MAGISTRACY:
The 2nd August, 1850.

P. S.—The "behrees," or lists of assessment of 3 mohullehs, as a specimen of the rest, are submitted for your inspection.

No. XLIX.

COMPARATIVE COST OF CARRIAGE ON METALLED AND UNMETALLED ROADS.

Extract of a letter of THE POST MASTER GENERAL, NORTH WESTERN PROVINCES, *to* THE HON'BLE THE LIEUTENANT GOVERNOR, *dated 30th September* 1850.

A calculation based on the returns of the Bullock Train, goes far to prove that without any reference to the general interests of the country, the want of a road to Lahore annually causes Government to incur an expense greater than would keep in repair, and pay interest on, the original cost of construction of a metalled road.

The following statement shews the actual number and weight of packages conveyed from Allahabad to Cawnpore, and from Meerut to Umballah, in the month of May 1850, together with the cost of establishment on each road. I have selected May as a month in which the establishment was fully employed, and one during which there are no difficulties arising from rain.

	Miles.	*Number of Packages.*	*Gross Weight.*	*Cost of Conveyance.*
			Mds. Srs. C.	Rs. A. P.
From Allahabad to Cawnpore,	125	3591	6002 26 9	1748 0 0
From Meerut to Umballah, ..	128	1992	2929 1 0	2632 10 8

The distances are nearly equal to each other, and to the distance between Kurnaul and Loodiana; so that the comparison can be at once applied to the latter line.

The result is that the actual cost of conveying and guarding one ton of goods on the metalled road is Rs. 8-2-1, while on the unmetalled road the cost for the same distance is Rs. 25-2-6. From these data it is easy to estimate the cost of leaving the road in its present state. The sums mentioned merely shew the actual charge of haulage in dry weather, and do not include the cost, and wear and tear of carts and wagons, or any estimate of the loss occasioned by the unmetalled road by delay caused by rain.

Rs. A. P.
0 1 0½, per ton per mile.

Rs. A. P.
0 3 1½, per ton per mile.

If the Markundah river be left out of consideration as impracticable, there is no engineering difficulty on any part of the line between Kurnaul and Loodiana. The streams which intersect it are of no great width. I believe kunkur is to be found in the neighbourhood of the road, and for upwards of 40 miles it runs through the territory of the Maharajah of Puttiala.

Even if the whole were completed by the British Government, the cost could hardly exceed Rs. 5,000 a mile. At this rate, the total cost would be about six and a half lacs of rupees. The annual cost of keeping a metalled road in repair is, I believe, about Rs. 300 a mile; all establishments included. The total annual charge on the road in question may therefore be reckoned at Rs. 70,900.

Interest on 6,50,000 at 5 per cent, ...	32,500	0	0
Annual repairs of 128 miles at Rs. 300 per mile, ...	38,400	0	0
	70,900	0	0

The difference in the cost of the conveyance of each ton of goods would be as above Rs. 17-0-5.

Charge for conveying one ton on unmetalled road, ...	25	2	6
Charge for conveyance of one ton on metalled road, ...	8	2	1
Difference,	17	0	5

If therefore the weight of goods, for the cost of conveying which Government is charged, amounts in the year to 4,164 tons, the whole cost of making and keeping the road in repair would be covered.

I have no means of knowing the weight which actually passes between the Provinces and Loodiana, en route to the Punjab, the

Jullunder Dooab and Ferozepore; but if Ordnance and Commissariat stores, baggage of troops, and miscellaneous articles for Civil Establishments, are taken into account, I conceive that on the average of years, the amount would not fall short of that indicated above.

To this must be added many advantages, the money value of which cannot be shewn; such as increased speed and regularity of the mails; the absence of all obstructions to the movement of troops; and the avoidance of the thousand annoyances, delays and injuries which are now caused by a shower of rain.

It is needless to dwell on the injury to the traffic and general interests of the country by a state of things which triples the cost of carriage, and for four months in each year practically closes all communication above Kurnaul and Seharunpore.

On the Trunk Road, a pair of bullocks can with ease drag a ton of goods. Even if, therefore, a toll of 5 rupees was imposed on each cart drawn by two bullocks, the merchant and public would gain 12 rupees in each ton of goods passing between Kurnaul and Loodiana.

No. L.

DEPOSITS OF GRAPHITE.

REPORT *on the* DEPOSITS OF GRAPHITE, *near Almorah, by* MAJOR H. DRUMMOND, *on special duty, dated 24th October,* 1850.

The occurrence of Graphite in the Himalayas was officially reported on in 1826, by Captain Herbert, Superintendent of a Mineralogical Survey. No bed or mass of the mineral however was brought to light, as will be seen by referring to Captain Herbert's report.*

When at Almorah last year, I observed traces of Graphite in the rock on which my house is situated, and was led to examine the ground in the neighbourhood, the result of which was the discovery of beds of the mineral in the mountain of Kaleemut about three miles north of Almorah, which I shortly described in a former paper. From one of these deposits, at the depth of a few feet, were obtained the specimens I had the honor of forwarding to the Most Noble the Governor General.

On my appointment by His Lordship to the prosecution of the research, I continued excavating in this quarter; but, no improvement in the mineral taking place, I ultimately abandoned the several openings made. The principal of these is an open working on the eastern side of the hill, measuring 65 feet horizontal and 34 perpendicular. To carry on the examination at this point, it would be necessary to sink a shaft to ascertain the character of other beds, which no doubt exist underneath.

After examining the ground in various directions, I selected two localities where a more favorable appearance presented itself; and, to avoid being tedious, confine my remarks to these at present.

The first is at Gurjolee, near the village of Bultee, about two and a half miles east of Kaleemut, and five from Almorah. The deposit worked here is observed when following the beds of plumbago, as they encircle the upper part of the valley of Mutteana, after leaving Kaleemut. The Graphite at this point occurs in the form of nodules, which differ considerably from those hitherto obtained at Kaleemut, being finer in appearance, and of small size, generally

* Published in *Asiatic Researches*, Vol. 18.

not larger than a walnut. On the first specimens obtained, Mr. O'Shaughnessy, Chemical Examiner, expressed an unfavorable opinion; but I prosecuted the working, from the impression* that their character gave promise of a better quality being discovered at a greater depth. This impression has to a certain extent proved correct. Specimen No. 1, exhibits the Graphite at the surface; No. 2, a change commencing at the depth of a few feet; from Nos. 3 and 4, it will be observed that still lower down, it is more compact and less earthy, and that some of the nodules exhibit the metallic lustre on the fracture. This mine has been worked to the depth of 46 feet.

The same description of nodular Graphite, I have since found cropping out in several directions, but always in small quantities; each deposit being only three or four inches in breadth.

The other locality alluded to is near the village of Pulseemee, about three miles from the Bultee mine, and the same from Almorah to the eastward. There are numerous deposits here. The first opened, crops out on the bank of a small stream in a deep ravine, and is composed of the mineral in tabular masses displaying metallic lustre. I was prevented by the water, from striking downwards, and therefore drove a gallery 70 feet in length along the course of the lode,† into the mountain, or rather shoulder of the mountain. The setting in of the rains, however, having swelled the brook and flooded the mine, I did not think it worth while to keep it open, as no apparent change had taken place in the mineral in that direction. About 200 feet lower down, the stream is joined by a smaller one, and in the bed of the latter before the rains commenced, I worked another deposit containing two layers of Graphite. The lower is from six to seven inches in breadth and displays the metallic lustre, the upper two feet thick of a much coarser character, and the metallic lustre is absent. The latter appears in the shape of a large solid mass crossing the bed of the smaller stream. A portion of this was loosened and carried down by the water, a fragment of which now lying about fifty feet from the spot, measures five feet six inches in length, two feet four inches in width, and two feet in depth. The remainder of the mass at the working still measures thirteen feet by ten. On the opposite side of the stream another deposit was found, five inches thick, with the metallic lustre, and lower down very large nodules exist in a bed of rock overhanging

* I have also understood, that the purest description of Graphite from Borrowdale generally occurs in small pieces.

† A technical term used in mining, to denote a course of ore whether in the character of a bed conforming with the strata of the country or a vein traversing the same.

SKETCH of the DEPOSITS discovered on the EASTERN SIDE of the RAVINE at PULSKEMEK.

the bank. I subsequently mined another deposit close to the first mentioned one, and here the metallic lustre is also apparent, but the masses differ in some respects from the other, being generally of a flattish nodular shape. They also vary considerably in quality, the greater portion being very coarse and stony, and some on the other hand much finer. For the reason stated above, namely, the proximity of the stream, I was obliged to cut into the mountain in the same direction, and not finding the mineral improve I discontinued it at 11 feet.

About the same time I came upon a deposit of nodules, and found along with them a mass of what appeared to be a broken nodule with considerable metallic lustre. This last presented a promising appearance, but I was again prevented by the water from mining on the spot, and cut the surrounding rock without coming on any thing similar. I then uncovered the surface of the opposite bank to observe the appearance of the strata underneath, and laid open a deposit of small nodules similar to those at Bultee. As at that place, all at the surface were earthy-looking, but after following the deposit into the interior of the mountain, the metallic lustre became visible in some of the nodules, about ten or fifteen feet from the entrance. I have only, as yet, mined this to the distance of twenty feet, in a contrary direction to the last mentioned excavation.

In order to obtain a better view of the strata and lay open any other deposits that might exist, I then removed the surface to a distance of 100 feet on both sides of the stream, and, whilst doing so, exposed three other beds of the mineral, marked 3, 4, and 5* in the accompanying Sketch, and several large nodules close to the first mine, (marked A). One of the latter shews the metallic lustre slightly. The western side of the ravine, below the mine (marked C), I have been unable as yet to expose, from the great depth of soil and accumulation of boulders of rock.

The whole of the deposits examined in the vicinity of Almorah are imbedded in a mica slate formation. The rocks in which Graphite is usually found, are granite, gneiss, mica slate, clay slate, &c., and the lowest of the silurian rocks. It is also found in the coal formation.

Avoiding more lengthened details, I proceed to notice the conclusions, which my observations have led me to form.

First—as regards quantity.

It is evident that the deposits of Graphite around Almorah, are on a very extensive scale. I have found nodules of all sizes; some

* None of these show the metallic lustre at the surface.

not exceeding the size of a pea, and the largest weighing 163 pounds. These exist, in deposits a few inches thick, as at Bultee, Mutteana and Sulla, about seven miles from Almorah ; at other times in great beds of rock, 12 feet and upwards in breadth, having the appearance so to speak, of shot in a wall. The latter sometimes contain nodules varying from one to five and six inches in diameter, as at Kaleemut and Punniala beyond Bultee ; others contain those of largest size, as at Mutteana, Pulseemee, and Sherar beyond the latter. The Graphite also occurs, as described above, in large tabular masses at Pulseemee, Sherar, Berowra and Pithownee.

Some idea may be formed of the magnitude of these deposits, by the breadth of carburetted rock in which those at Kaleemut are found. This may be well observed on the ridge of that mountain, where the formation crosses the road to Hawilbagh. It measures 1800 feet, and allowing for the winding of the road may be reckoned 1600.

Whilst opening the ground at Pulseemee to observe the character of the mineral, without reference to quantity, at mine A, and the smaller lode described as in the bed of the stream, I turned out upwards of 15 tons. Had quantity only been looked to, and a continuous working been carried on at this spot, I have no doubt 100 tons might as easily have been obtained.

Secondly—as regards quality.

Though none of the Graphite hitherto obtained can bear comparison with the specimen of pure Cumberland plumbago, transmitted by the Hon'ble Court of Directors as a standard ;* I do not consider it improbable, that a valuable article may yet be discovered. This belief I ground on the following reasons.

1. The Borrowdale mine in Cumberland has been worked for upwards of two centuries, and of course, any specimens from the present workings must be from a considerable depth. A fair comparison therefore cannot be drawn between these and any procured from the workings here, which as yet must be looked upon as entirely superficial.

2. All that was formerly known regarding Himalayan Graphite, was the fact, that it existed in the form of nodules ; that the fracture surface was dull and earthy-looking, never exhibiting the metallic lustre till cut or rubbed. It will now appear by specimens from Bultee and Pulseemee, that even at a short distance from the surface, several of the nodules bear a considerable lustre on being fractured. It has also now been discovered for the first time in tabular masses.

3. The deposits already opened differ materially from each other even at the surface. What they may prove to be on deeper mining has yet to be ascertained.

* The specimen is now deposited in the Museum of the Agra College, where it is available for reference.

4. There are many localities in the surrounding country still unexamined, and the quality of these cannot be determined by any already laid open.

5. On a small selected specimen from mine A, at Pulseemee, Mr. O'Shaughnessy gives the following opinion. "Of the two samples sent, one is of very good quality, and stands fairly a comparison with the plumbago used for manufacturing the *second* quality of drawing and office pencils. In the color and quantity of ash, the time of combustion, and other particulars (more technical than chemical) your plumbago (the card-box sample) and *ordinary* Cumberland differ but little from each other."

To conclude—while the discovery of such pure material as that transmitted by the Hon'ble Court would be a truly valuable one, it must be borne in mind, that there are other varieties, which, though containing a portion of earthy matter, would still be highly remunerative. For example the rock plumbago of Cumberland, alluded to by Mr. Brockedon, which he mentions having bought for "less than £50 per ton."*

There is little doubt however that these deposits will ultimately prove of value, wholly unconnected with the manufacture of pencils. It seems highly probable that the process mentioned in the accompanying memorandum by Mr. Rose, Mineralogist, namely, the separation of foreign substances by pounding and washing, might be carried on with advantage in a district like this.

The abundance of water-power in every direction would afford the facility necessary for working small mills of simple construction, and these could be erected at a trifling expence. I am yet in ignorance what proportion of the pure mineral must be contained in the plumbagos which pay for this process; but even should they prove to be of finer material than any that exist here, it is not unlikely that the great abundance of the article may compensate for the superfluity of extraneous matter.

The Americans use this substance (procured from a mine in North Carolina) in various ways, "being ground with oil for painting the wooden roofs of their buildings, and being used in different ways as a preservative from decay, and also from fire to which its incombustible character well fits it."

I have had experiments made to ascertain whether any preparation of this kind would prevent the ravages of white ants† in

* Letter from Mr. Brockedon to R. Phillips, Esq., 16th April, 1850.

† White ants do not attack wood when covered with the black lead, if arsenic be added.—Since writing the above, I have ascertained that no white ants will attack timber covered into plumbago, when the latter is mixed with oil extracted from the Deodar Pine. This being a less expensive process than the above, and not so objectionable, is, I think, worthy of consideration.

combination with the advantages abovementioned. Hitherto these have failed, but I have directed further trials to be made which I am not without hopes may succeed. Conductor Wallace is now trying if the mineral mixed with oil, may be rendered applicable to the protection of the wood and iron work of bridges, in place of the expensive coal tar now in use, which is found on experience to melt with the heat of the sun in the vallies.

One of the most important uses to which Graphite is applied, is to diminish the friction of machinery, and for this purpose alone it must eventually be greatly in request in this country. When the other important mineral resources are opened up, it is obvious, that the large amount of supply of this substance, must prove highly advantageous.

H. DRUMMOND, MAJOR,
On Special Duty.

ALMORAH:
24th October, 1850.

Remarks of Mr. Rose, Mineralogist, with reference to specimens of Graphite forwarded to Major Drummond.

Graphite is applied to several purposes. When very fine, compact and of a sufficient cohesion, it is cut up for drawing pencils. When the texture is loose, or it is otherwise of inferior quality, it is ground down, and deprived of foreign substances by washing; as ores of metals are prepared for smelting. The powder thus purified is then used for various purposes, such as crucibles, (being refractory or infusible by heat), for burnishing iron, and reducing the friction of machinery.

A new method is now adopted for making artificial pencils, which are scarcely if at all inferior to those sawn out of the finest blocks. The dust of such fine material as Nos. 4, 8, and particularly No. 10, properly prepared, is subjected to vast hydraulic pressure, (several hundred tons) and thus acquires the compactness and solidity necessary for the best purposes.

The best kinds of Graphite may be known by a pale lead blue color, high lustre, unctuosity, and inferior specific gravity.

The first nine specimens will answer for pencils, most of them sufficiently pure and compact, to be divided for that purpose.

All the varieties sent may be used, even No. 13, though connected with much matrix; as it can be deprived of this by grinding and washing.

All the varieties of this substance must continue in demand, and bring remunerating prices, if the expence of mining and conveyance should not be too great.

No. LI.

REPORTS OF THE "OOTHAEEGEERAS" OR THE SUNOREAHS OF THE TEHREE, DUTTEAH, SHAHGURH, AND CHUNDEYREE, OR BANPOOR STATES.

No. I.—LETTER *No.* 11 *of* 1851, *dated Camp Khutoora, the 7th February* 1851, *from* G. A. BUSHBY, ESQ., C. S., *Agent Governor General for Scindia's Dominions, to the Secretary to the Government of India, with the Governor General.*

SIR,

I am not aware that the practices of the "Oothaeegeerahs," or Sunoreahs, of the Tehree, Dutteah, Shahgurh, and Chundeyree or Banpoor States, have been before brought to the notice of the Government of India, or to the Governments of the subordinate Presidencies. I therefore submit the copy of a Report, from Major Harris, Superintendent of Chundeyree, dated the 31st January, containing information respecting the proceedings of the above-named people, which the Most Noble the Governor General may deem deserving of distribution to the Magistrates, and communities of India, for the purpose of putting them properly on their guard against the arts performed by Sunoreah professional thieves, for the purpose of obtaining other person's goods.

2. The Bundlecund States implicated herein (with exception of Chundeyree,—which is a part of the Territory assigned by Scindia for the expences of the Contingent under the Treaty of 1844; at present under the management of the Superintendent Major Harris) exercise an independent rule within their own limits. Banpoor is a small State, now representing the Raj of Chundeyree, which was spoiled by Scindia. We obtained from Scindia a restitution to the Banpoor Raja of one-third of Scindia's usurpations; and the other two-thirds, which he retained, were eventually ceded to us by the Treaty just mentioned.

3. The connection of the Government of these States, with professional thieves and vagabonds, is an apt commentary on the

morals of the Boondela Princes and Principalities. They are the offspring of plunderers, and had never known Civil laws, or national obligations and restraints, till their relations with the British power brought them into contact with the European system of civilization and manners.

4. How naively do the State of Tehree, and the Raja of Banpoor, confess themselves to be the confederates of thieves!

5. I transmit also a copy of Major Harris's letter to me, dated the 30th January, and English enclosures, in the case of the 14 Sunoreahs, who robbed the Calcutta shopkeeper in February last year of 3,000 rupees worth of property; all of whom (except No 14, the approver to whom the Superintendent promised pardon) I have sentenced to an imprisonment in the Lullutpoor Jail for seven years with hard labor, as will appear from the copy of my reply also transmitted.

Act XI. 1848.

6. I take the liberty of recommending that the States who are known to harbour professional thieves, have a severe lecture read to them; and that Tehree and Banpoor on this occasion be fined,—the former in the sum of 5,000 rupees, and the latter in the sum of 1,000 rupees, for the reparation of the injury done to the British subjects, who suffered from the exploits of their Sunoreah subjects in February last at Calcutta, and to meet the cost of dieting and detaining the 13 convicts in prison for seven years.

I have, &c.,

G. A. BUSHBY,

Agent Governor General.

GWALIOR AGENT'S OFFICE,
CAMP KHUTOORA:
The 7th February, 1851.

No. II.—LETTER *from* MAJOR HARRIS, *dated* 31*st January* 1851.

SIR,

I have the honor to report, that when investigating lately a case of extensive robbery committed in Calcutta by the notorious Sunoreahs, or Oothaeegeerahs of this part of the country, circumstances were revealed, that convinced me that the organized system under which these people carried on their calling, to the remotest parts of Hindoostan, was unknown to our Government Officers.

2. They have hitherto, I believe, been considered in the light of travelling shoplifters, who, when detected on a summary enquiry, received ten or a dozen ratans, and were let loose to carry on their profitable calling with almost impunity.

3. I have submitted to you in the accompanying roobucarree, a full and particular account of these people, derived from the evidence of their chiefs, taken on oath in my presence, and attested by two respectable witnesses, which I think may prove interesting, as well as a useful check on these people, if made known to all Magisterial Officers throughout India.

4. During the investigation of the Calcutta robbery, before referred to, the following villages were named, as being especially Sunoreah villages, and known throughout India amongst the Sunoreahs as "the 12 villages"—Baragaon.

1. Churpoora,	Tehree.	7. Muroura,	Shahgurh.
2. Hurpoora,		8. Banpoor,	Banpoor.
3. Munowra,		9. Beer,	
4. Jumrar,		10. Oodair,	
5. Tendaree,		11. Rora,	Dutteeah ;—
6. Kurmaree,		12. Purhree,	

all inhabited chiefly by Sunoreahs ; bunneeahs, chumars, and mehters, being the only castes who are excluded from the brotherhood.

5. The same rules are observed by the Sunoreahs of all these villages, though the present enquiries have not embraced those of the Dutteeah State.

6. Gharebah Sunoreah, resident of Hurpoorah, in the Tehree district, whose family for seven generations had been Sunoreahs, offered to give me information of several extensive robberies that had been committed within the last two years by these people, in the most distant parts of India, viz :

No.		
1.	Panwell near Bombay, ...	A Watch.
2.	Dooleah in Kandeish, ...	Rs. 1,700.
3.	Ahmedabad in do., ...	
4.	Garuspoor, ...	Rs. 1,656.
5.	Bombay,..	A Watch.
6.	Nagpoor, ...	
7.	Jubbulpoor, ...	Rs. 875.
8.	Nasuck, ...	
9.	Jubbulpoor, ...	Rs. 686.
10.	Dooleah in Kandeish, ...	Rs. 700.
11.	Patna, ...	Rs. 509.

and produced "dussees" or clues to them.

7. Finding that one of the elders in high estimation of the brotherhood, had betrayed the secrets of the craft ; I received a deputation from the heads of the "Baragaon," stating that they would answer faithfully any enquiries I wished to make.

8. They distinctly affirmed on oath, that their pursuits were well known to their own governments, that the lumburdar of the village on the part of the Government is the appointed mookeea or chief of the Sunoreahs of his own village.

9. Each village has from seven to ten "nals" or gangs registered by their Government; Lala Kishore canoongoe being the official at Tehree who keeps the Sunoreah duftur. The Sunoreahs number upwards of 4,000 in Tehree, about 300 in Banpoor, and about 300 in Dutteeah.

10. That Ladlee Koorea is the appointed mokuddum, or head mookeea, on the part of the Tehree Government, over the twelve villages; whose duty it is, to arrange all disputes amongst the Sunoreahs arising from unfair division of spoils, and to receive from the Sunoreahs, on their return from distant expeditions, articles of "vertu" or value, worthy of being appropriated by their Government.

11. The mookeeas state, that immediately after the Dusserah, every year, the gangs of the several villages depute their mookeeas to consult their favorite brahmin priest, (who resides at Lahur in Chundeyree) as to the propitious signs to be observed by them. After due time he informs the applicant that his luck will be towards the south, and such an hour and day is propitious to start.

12. This is communicated to his own gang, and an invitation given to all stragglers who do not belong to any particular village, or gang, to join in the distant excursion. At the time named, they all meet at an appointed well, or tope, and start (for instance) for Jubbulpoor,—the south having been the propitious point of the compass indicated.

13. Arrived at Jubbulpoor, (the gang consisting of fifty or sixty men,) the mookeeas tell them off into parties of ten or twelve, appointing a sub-mookeea, to take charge of them and give an account hereafter of their earnings; merely expending what is necessary for their actual subsistence:—these parties being detached severally to Nagpoor, Hyderabad, Indore, &c., the head mookeea of the "nal" retaining a strong party with himself at Jubbulpoor, to carry on operations in that large city till the return of the detached parties, who are enjoined to return, whatever may be their success, in the following July to Jubbulpoor, to render an account of their proceedings.

14. Should the amount be equal to forty or fifty rupees to each individual, they return at once to their houses, in time to cultivate the land for the summer crops. If the amount to be divided does not equal their expectations, the parties are again detached (but changing directions), by the head mookeea, who returns himself with the several shares, and distributes them to the families of his party.

15. Should there be any valuable, worthy of being presented to the Government, the mookeea of the gang, accompanied by the lumburdar or mookeea of the village, proceeds to Ladlee Koreah, the head mookeea of the twelve villages, who, with the mookeea of the village in question, proceeds to Tehree to deliver up the *huqq* of the Sirkar.

16. It was stated by all the mookeeas in the course of this enquiry, that their office was *hereditary* in their families. When failing male issue, descending to the women: as was disclosed in case No. 1 noted above, wherein Nunhee Mehtun, a woman, was the mookeea, and she deposed that she received the watch from her nal, and delivered it to the Raja of Banpoor.

17. In the Kandeish (Bombay Presidency), cases Nos. 2 and 10 of the list before mentioned, it was proved that two very handsome and valuable pearl nose-ornaments were presented by the gang through Ladlee Koreah, to the Tehree Government, for which the thief received from the Government fifteen beegahs of land as a rent-free grant, in perpetuity; on the occasion of this robbery, the property stolen was estimated at Rs. 2,500, which I have traced. Such aggressions upon our subjects cannot be called trifling, or petty thefts.

18. In the Patna case, amounting to 509 rupees, it was proved, that a handsome pair of arm ornaments valued at 100 rupees, reached the Raja of Banpoor: also, in each of the Bombay cases, a watch reached the Raja of Banpoor: these robberies having been committed by Sunoreahs of Beer in the state of Banpoor.

19. The Governments of the Tehree and Banpoor States, being known to tolerate and reward these people, they dispose of their spoils in open day, in the market places, and bazars of those States, to seths, sonars and bunneeahs, who are all well acquainted with the calling of these people, and afford them a ready opportunity of selling gold, and other valuables at half their value; and thus an encouragement is afforded them to pursue their thieving avocations.

20. During their absence for one or two years on a distant excursion, the village money-lender feeds the Sunoreah's wife, and family, and takes broken gold, or gold mohurs, (stolen property) at little more than half their value in payment of the account run up in his absence.

21. Deoree Singhaee, of Tehree, is proved to have bought openly a bar of gold, part of the Kandeish robbery, seventy-nine tolahs of the finest metal at Rs. 16-6, (the market price for the same kind being 21 rupees per tolah,) knowing that such a valuable could not have been obtained by fair means; and he acknowledges to the same. The owner was a banker travelling from Bombay westward,

and cannot be discovered; yet as the robbery was committed in our territory, as confessed to, our Government has a claim to the proceeds as "lawarissee." The exacting such, as a fine, would be the greatest check possible to the Sunoreahs finding ready purchasers for their stolen spoils.

22. Finding by the sworn testimony of all the mookeeas, that the States of Tehree and Banpoor openly received all articles of value, obtained by the robberies of the Sunoreeahs who resided in their several villages, I invited both these States to communicate what was their practice relating to them. Copies of the Khureetahs from both States, are attached to these proceedings; in which the facts deposed to, are admitted; and the plea advanced by both States, for tolerating such practices, is the circumstance that no Government, British or Native, had ever forbidden them.

23. It is necessary to remark, that these people never practise their calling in the States where they are tolerated and recognized.

24. One of the most important points elicited by the investigation is, that they have a slang or "bolee" of their own, well known to the brotherhood throughout India, their children being instructed in it from early youth. I have attached to the proceedings a list of several words chiefly in use with them; obtained from the mookeeas while under examination; admitted by several with great reluctance, who indignantly asserted that, had not Ghareeba (my informer) faithlessly betrayed the craft, they would have allowed their flesh to be torn from their bones, rather than have disclosed a word; that as often as they had been apprehended on suspicion, or been detected with stolen property on them, such a disclosure of their system and bolee, had never been made, but now their calling or occupation would be gone.

25. They have their "chounees" or head quarters in the several parts of India they resort to.

26. For Calcutta, the Suraee of the Raja of Burdwan is their chounee; where there are never less than 200 Sunoreahs practising their calling on the unwary travellers who partake of the hospitality of the Raja; the Sunoreahs themselves receiving daily, with the travellers assembled, their food from the bounty of the Raja. From this depôt, the "nals" or gangs in Calcutta are reinforced, returning to this favorite resort to account for or divide the spoils accumulated in Calcutta. "They state that the alms or food is "daily distributed morning and evening by the mahunt of the "byragees at Burdwan, whose residence is on the banks of the "Ganges; on which account numerous Sunoreahs are to be found "daily attendant at the mahunts. The Sunoreahs, while at Burdwan, "fix their resting place at a ghât on the Ganges, that has an almond "tree shading it, and they always represent themselves as proceeding

"to Teerutt. When the travellers at that ghât acknowledge themselves to be from Oorcha or Tehree, Chundeyree, Dutteeah, Shahghur, "Chatterpoor, Chitterkote, &c. &c., in Bundlecund, it may safely "be concluded they are Sunoreahs."

27. To the south of Lal Gola, eight koss north of Moorshedabad, where the high road to the north-west branches off, there is a tank, south of which in a garden belonging to a Baboo who daily distributes alms to travellers, the Sunoreahs have established a chounee; from which they carry on their depredations, at the fair of Megh Murd, held at Deenatpoor in Rungpoor; returning with their spoils to deposit with their friends the gwallas and bunneahs of Lal Gola, who well know the Sunoreahs. At the end of their season in June, they dispose of all their spoils, of the surrounding neighbourhood, to their friends of Lal Gola, turn the proceeds into gold, and return to their homes in July.

28. In the city of Rajmehal, the Tehree Sunoreahs have formed an extensive "chounee," at a mohulla known by the name of "Tewarey purdasee's" mohulla, and though he and the family have resided at Rajmehal for three or four generations, his ancestors were of the Oorcha or Tehree States. On this account the Sunoreahs of Tehree, being considered to be fellow-countrymen, he permits them to occupy houses in his "mohulla," knowing well their calling, and the mookeeas state, that not only does Tewarey himself purchase all their spoils, but there is not a resident in the mohulla, be he bunneah or be he Musselman, that does not purchase from them! A nest of receivers of stolen goods!

29. For the south, Gopalpoor ghât, near Jubbulpoor, is the chounee or depôt.

30. For Bombay and Goojrat, the village of Nuriyard, three koss north of Ahmedabad in Goojrat, is the chounee: the lumburdar of this village receiving a portion of the spoils of each gang, to secure his good will.

31. Having related all that occurs to me to be necessary, beyond what is set forth in the Persian roobucarree, I beg to suggest that the States of Banpoor, Tehree, and Dutteeah, have it in their power to break up this organized system of robbery, practised on British subjects throughout India, by their subjects, with their knowledge and approval; a system that is governed by the rules of discipline, from the Government servant who keeps the register of these people, through the several grades of mookeeas, to the single Sunorcah, who owns to no village or particular gang. The States of Tehree and Banpoor have solicited the orders of our Government for the future, for their suppression.

32. When communicating with the Magistrate of Patna relating to the cases in the list, he expressed a wish that I would furnish

him with all the particulars I could of the manners and habits of these people. I would beg to suggest, with deference, that an outline with a list of their "bolee" or acknowledged slang, hitherto quite unknown but to themselves, might be published for the general information of Magistrates and Police Officers. This knowledge might be a great check to the gangs of those people who at this time are spread over India pursuing their robberies.

33. Ghareeba the Sunoreah who was my informer, and disclosed the whole of the system, will be no longer tolerated in Tehree, either by the Government or his fellow Sunoreahs. I would beg therefore to recommend, that one of the old and ruined villages that have nothing left but the name, and of which there are many in the Mahrownee district, may be given to him for a term, on a nominal rent, where he may settle with his family and followers, and take to the plough for the future.

I have, &c.,

P. HARRIS, MAJOR,

Superintendent, Chundeyree.

LULLUTPOOR: *The 31st January*, 1851.

Translation of Khureeta, from the Raja of Banpoor, dated 22nd November 1850.

After compliments, states, "your Khureeta has been received, mentioning that from the evidence of several Sunoreahs, a watch stolen by the Oothaeegeerahs has been presented to me through Khyramut Khan, Ram Pershaud, and Hindooput chowdry, and that Nunhee Mehtun confirms the same. You have enquired the circumstances from me. I have to state that, from former times, these people, following their profession, have resided in my territory and in the States of other native Princes; and they have always followed this calling, but no former Kings or Princes or authority, have ever forbidden the practice; therefore these people for generations have resided in my territory and the States of other Princes; proceeding to distant districts, to follow their occupation, robbing by day for a livelihood for themselves, and families, both cash, and any other property they could lay hands on. In consequence of these people stealing by day only, and that they do not take life, or distress

any person, by personal ill-usage, and that they do not break into houses, by digging walls or breaking door-locks, but simply by their smartness manage to abstract property; owing to such trifling thefts, I looked on their proceedings as petty thefts, and have not interfered with them. As many States as there may be in India, under the protection of the British Government, there is not one in which these people are not, to be found, and it is possible that in all other States, who protect them, that the same system is pursued towards them:, as in my district; and besides, these people thieving only by day, the Police Officers in the British Territories, are not expected to exert themselves, the loss having occurred simply through the owner's negligence. Owing to this circumstance, your friend looking on their transgressions as trifling, I have not caused my Police to interfere with them.

The British Government who issue orders to all the native powers in India, have never directed the system of Sunoreahs to be stopped. From this I conclude that their offence is looked upon by the British Government, as trifling; and probably this is the reason, that neither the British Government, nor any other authority have ever directed me to stop their calling; and on this account, from property that they have brought home, and I have heard that it suited me, or that they themselves, considering the article to be a curiosity from a distant province, have presented to me through my servants, thus, viewing the offence as trifling that there was no owner to the property, I received it from them, and gave them a trifle in return.

There is nothing strange in buying an article for less than its value. People make up articles at a great cost, and sell them when they require cash at much less than their value. In this way the bunneahs in open bazar throughout the native States, buy from the Sunoreahs; but since the case of the Sunoreahs has been taken up by you, and you have diligently enquired into the system of Oothacegeeree, summoning several of these people from Teekumgurh, &c., and feeling that my territory is under your charge, and that you are my friend, I was about to consult you for advice relating to these people, when your letter reached enquiring their practices and encouraging me in a friendly way, to write the truth. With feelings of friendship, I have written the whole of the system to you, and I now seek your advice what to do. I shall not decide on any thing, till advised by you in this matter, and as appears best to you, relating to these people. Do me the favor to communicate your directions, and hereafter there shall not be the slightest deviation from your instructions, always conforming strictly to your orders," &c. &c.

Major Harris also furnishes a translation of a Khureeta from the Dowager Queen, or Ranee of Teekumghur, in reply to his Khureeta, on the subject of the Sunoreahs throughout the Tehree district. The Khureeta from Tehree, he observes, corresponds word for word with the above, from Banpoor, with simply the following addition.

"Occasionally the owner searching for his property from other districts, has complained. Immediately his property has been restored to him, and the thieves have been punished."

Specimen of the "Bolee" or Slang Language used by the class of professional Thieves, in Bundlecund, called Sunoreahs, or Oothaeegeerahs.

English.	Sunoreah's Language.
Grain seller, ...	Surrooa.
A Bag, ...	Rontra.
Havresack, ...	Suttoo,a.
Box, ...	Pinjuree,a.
Shawls and valuable cloths, ..	Santa.
Broad Cloth, ...	Roongee.
Shoes, ...	Gonnee,a.
Brass Pot, ...	Pynee.
Brass Plate, ...	Thunkee.
Brass Vessel, ...	Kholah.
Flannel, ...	Ringultee,a.
Sword, ...	Dharraree.
Gun, ...	Bhurkunnee.
Dagger or 2-bladed knife, ...	Kuppoo,a.
Nose Ring, ...	Nuklee.
Pearls, ...	Nujjoo,a.
Coral, ...	Hurkee,a.
Turban, ...	Agassee.
Europeans, ...	Topee,a.
Police Officers, ...	T,hola.
Policeman, ...	Kuppuree,a.
A Pipe (Hookka), ...	Putputta.

ENGLISH.	SUNOREAH'S LANGUAGE.
Soldiers,	Oongna.
Waist Cloth,	Punfutto.
Cash in Silver,	Dhumree.
Gold Mohurs,	Nug.
Copper Cash,	Dharro.
Silver,	Oobbun.
Gold,	Seeand.
Diamond,	Kukura.
A Pipe,	Putputta.
Jewels,	Oothar.
Silversmith,	Kue, yar.
Cloth Merchant,	Khujjar.
Banker,	Tulleeah.
River,	Teeree.
A Fair,	Beeuh.
Net for carrying rupees tied round the waist, (Himmiyanee),	Bigoree.
Village,	Bang.
City,	Burra Bang.
Horse,	Furka.
Camel,	Lumgeech.
Elephant,	Sonree,a.
Muhammedan,	Koongee,a.
Brahmin,	Khoosur.
Kutcherry Officials,	Muska.
Gang of Sunoreahs,	Naal.
Eat your bread quickly,	Tapee, nikallo.
To be seized or apprehended,	Tig-guya.
When apprehensive of detection,	Bheer ayee moondeéa bqora, dekhlata hue.
Run, make off,	Lud jao.

Pirrooa, a boy about ten years of age, I examined myself on the above list, and he confirmed every word; as also Joga his brother, seven years of age, having been instructed from early youth.

P. HARRIS, MAJOR,

Superintendent, Chundeyree.

No. LII.

EXPENCES OF THE SURVEY AND SETTLEMENT OF THE NORTH WESTERN PROVINCES.

LETTER *No.* 362 *of* 1850, *dated 9th August, from* W. MUIR, ESQ., *Secretary to the Sudder Board of Revenue, North Western Provinces; addressed to* JOHN THORNTON, ESQ., *Secretary to Government, North Western Provinces, respecting the Expences of Survey and Settlement.*

SIR,

Present:
H. S. BOULDERSON, ESQ., *Senior Member.*

With reference to the orders contained in your letter No. 2733, dated the 5th July 1847, I am now directed by the Sudder Board of Revenue, North Western Provinces, to submit for the consideration of His Honor the Lieutenant Governor, a statement exhibiting the expences incurred by the late Survey and Settlement of the North Western Provinces.

2nd. The Board have experienced much assistance from Mr. P. B. Reid, Deputy Collector of Agra, in the preparation of this return. It has been drawn up almost entirely from the records in the Office of the Revenue Accountant. A copy of an explanatory

note by Mr. Reid is enclosed, from which His Honor will perceive the very detailed and laborious process by which every Settlement and Survey charge has been sought out, and the whole thrown together and tested. The expenditure during the year 1833-34 alone has been obtained by a reference to the district officers and their accounts; the records of the Revenue Accountant commencing from after that period. The delay in forwarding this statement has arisen from the tedious process above referred to, and the necessity of repeatedly remanding it for alteration and amendment.

3rd. The aggregate of the entire expenditure is Rs. 57,27,249, which applied to the juma of the years 1846-47, [Rs. 4,05,29,921,] falls at the rate of Rs. 14·13 per cent. The assessment of such districts* as did not come under the operations of Regulation IX. of 1833, has been excluded from this and the following calculations. The rate per cent. upon the area, calculated in acres, [Rs. 4,60,70,653], falls at Rs. 12·43.

4th. *Survey Charges.* The Board proceed to notice the portion of the above sum which falls to expences connected with the Survey. It amounts to Rs. 28,56,555, and falls at the rate of Rs. 5·81 per cent. on the juma; and Rs. 5·11 on the area.

5th. Three items have been separately classed in the statements A, B, and C. The first embraces charges on account of the office of Superintendent of Surveys at Allahabad, and contains the following details :—

Captain Bedford's establishment and charges,			Rs.	1,62,048
Mr. H. M. Elliot's	ditto	ditto,	,,	55,292
Captain Wroughton's	ditto	ditto,	,,	25,066
			Rs.	2,42,406

The details of heading B, consist of charges incurred by the Surveyor General at the Presidency, and charged against the Survey of these Provinces, amounting to Rs. 20,565. The sum of Rs. 2,05,952, denoted by C, represents the "Batta gratuity, &c., paid to the Officers of the Military Department while engaged on the Survey, and similarly debited to the North Western Provinces.

6th. The remaining sum forms the direct expenditure of Survey, and has been distributed over the several districts. But the result

* Province of Kumaon, districts of Bhuttecana and Dehra Dhoon.

cannot be trusted *in detail*, because the Surveyor and his establishment were often borne nominally upon one district, while they were employed in the Survey of another. The expenditure classified by divisions is noted in the margin,* though even here the same cause produces a dubious result. The rate upon the whole falls at Rs. 4·66 per cent. on the juma, and Rs. 4·09 on the area.

* Division.	Survey Charges.	Percentage on	
		Juma.	Area.
Delhie, ...	79,941	2·44	1·48
Meerut, ...	1,39,196	2·01	2·14
Rohilcund, ...	3,83,940	6·01	4·73
Agra, ...	2,59,040	3·53	4·46
Allahabad, ...	3,54,747	4·13	4·68
Benares, ...	6,70,767	8·35	5·28
Total, ..	18,87,631	4·66	4·09

7th. The entire expences of the Survey constitute 41·15 per cent. of the combined expenditure of the Settlement and Survey.

8th. *Settlement Charges.* The charges proper to the Settlement form the remaining 58·85 per cent., and amount to Rs. 33,70,694.

9th. This falls at the rate of Rs. 8·31 per cent. upon the juma, and Rs. 7·09 upon the area.

The charge may be classified as follows:—

		Amount.	Proportion.
I.	Salary of Covenanted Officers, Rs.	11,09,052	32·90
II.	Ditto of Deputy Collectors under Regulation IX. of 1833, ... „	4,26,586	12·65
III.	Office and Establishment, ... „	15,43,781	45·80
IV.	Contingencies, ... „	2,91,275	8·65
	Rs.	33,70,694	100·00

10th. It is to be remarked that only those Officers appointed expressly for Settlement duty, over and above the usual establishment of a district, have been entered in this account. Where a Collector, for instance, performed the duties of a Settlement Officer, no charge would appear on his account under the first head. This will explain much of the inequality which is apparent in the pro-

portion at which the Settlement charges fall upon individual districts. Thus to take the two first districts.* In Paneeput the allowances of Messrs. Edmonstone, Barnes, and Mill, continuing for four years, contribute to swell the rate of Settlement charge: while that of Hissar is much below the average, the Settlement duties having been performed by the Collector.

* District.	Percentage of Settlement Charge on	
	Juma.	*Area.*
Paneeput, ...	12·52	12·41
Hissar, ...	4·87	1·04

11th. The districts in which the expences have fallen heaviest are specified below. In all of them except Delhie, the charge for Covenanted supervision forms an important item.

	Rate per cent. on	
	Juma.	*Area.*
1. Humeerpoor,	16·45	13·27
2. Etawah, ..	15·55	19·01
3. Moradabad,	14·93	10·13
4. Calpee, ..	13·18	11·08
5. Paneepnt, ..	12·52	12·41
6. Ghazeepoor,	12·08	12·92
7. Delhie, ..	11·24	10·19
8. Benares, ..	10·66	14·18
9. Mynpoory,	10·43	11·02
10. Budaon, ..	10·36	7·49
11. Goruckpoor,	11·75	5·29

12th. The districts in which the expences fall lowest are the following.

	Rate on	
	Juma.	*Area.*
1. Muttra, ..	2·07	2·29
2. Meerut, ..	3·50	3·08
3. Rohtuck, ..	4·50	3·29
4. Hissar, ...	4·87	1·04
5. Furruckabad, ..	5·05	5·81
6. Boolundshuhur,	5·06	4·44

In all these districts there is either no charge or a very low one, on account of Covenanted Officers.

13th. The following is an abstract of the percentage of Settlement charges upon each division.

Division.	*Charge per cent. on the*	
	Juma.	*Area.*
Delhie, ...	7·71	4·67
Meerut, ...	6·37	6·50
Rohilcund, ...	8·87	6·09
Agra, ...	7·80	9·85
Allahabad, ...	8·26	9·34
Benares, ...	10·33	6·53
Upon the whole, ..	8·31	7·53

14th. It should be borne in recollection that the calculations are framed upon the assessment of 1846-47; and that wherever the juma is progressive, the percentage would fall lighter if deduced from the full ultimate assessment. In juxta-position with the demand of 1846-47 has been placed that of 1824-25. There was a difficulty experienced in ascertaining the juma of 1229 Fuslee (1821-22) the year suggested in your letter.

15th. On referring to the various reports of the Settlement Officers, as directed in the 3rd paragraph of your letter, the Board do not find any notices of such a description as to illustrate the subject now reported.

I have, &c.,

Your most obedient Servant,

W. MUIR,

Secretary.

SUDDER BOARD OF REVENUE, N. W. P.,
The 9th August, 1850.

STATEMENT OF EXPENCES INCURRED IN SURVEY AND SETTLEMENT OPERATIONS UNDER REGULATION IX. OF 1833,

In the Districts of the North Western Provinces, from 1833-1834 to 1845-1846.

Division.	Districts.	Salaries of Covenanted Settlement Officers, their Travelling Allowances, &c.	Salaries and Allowances of Deputy Collectors under Reg. IX. of 1833 employed in Settlement Work.	Subordinate Establishment employed on Settlement Work.	Contingencies and Travelling Allowances of Establishments, &c.	Total of Settlement Charges.	Professional Survey. Salary of Surveyor's Establishment and Travelling Allowances charged in Collector's Accounts.	Gross Total of Settlement and Survey Charges.	Land Revenue Demand for the year 1845-46.	Revised Jama of Districts taken from the General Jama Statements on account of 1846-47.	Area of Districts in Acres.	Percentage of Charges of Settlement (Col. 7), on revised Jama.	Percentage of Expenses of Survey (Col. 8), on revised Jama.	Percentage of Settlement and Survey Charges (Col. 9), on revised Jama.
		1	2	3	4	5	6	7	8	9	10	11	12	13
Dehra.	Pergunt,	40,179		66,479	14,802	1,21,710	195	1,21,915	2,30,850	4,12,699	919,107	29·52	·01	29·53
	Hawai,	"		13,020	2,326	22,167	24,613	46,993	1,03,003	4,34,937	8,218,067	4·42	5·69	13·46
	Dehra,	"		24,193	4,704	39,505	39,380	77,668	2,32,167	3,49,474	395,695	21·24	10·97	32·21
	Kalsuk,	10,979		13,319	3,854	29,273	0	29,273	1,31,360	2,26,764	329,750	8·30	0·	8·30
	Goorgaon,	"		42,929	17,866	81,671	9,083	71,344	2,04,604	20,20,114	2,243,958	3·52	·32	3·84
	Total,	51,278		1,51,940	43,571	3,14,326	73,161	3,87,575	10,75,571	37,93,219	3,405,508	7·71	2·41	10·12
Meerut.	Saharanpur,	89,899	10,146	19,199	7,254	1,26,498	63,624	1,90,122	13,85,891	22,54,555	3,268,999	8·45	2·80	17·25
	Muzaffarnuggur,	42,926	7,290	40,229	8,388	98,833	226	99,059		22,86,762	3,888,999	4·42	·02	4·44
	Meerut,	58,758	610	39,871	8,864	98,499	21,928	92,856	12,85,999	17,55,716	3,492,995	5·30	1·26	6·56
	Bolundshuhur,	4,184	33,643	31,395	4,761	92,749	4,653	96,411	8,87,623	20,30,891	3,242,260	4·06	·22	4·27
	Aligurh,	30,784	19,577	34,978	10,934	1,36,833	10,599	1,46,932	15,25,833	20,62,966	3,375,695	6·12	1·03	7·15
	Total,	1,26,209	71,266	1,47,672	40,200	4,80,190	1,00,596	5,80,986	52,35,723	81,30,973	8,870,666	6·57	1·23	8·80
Bareilly.	Bijnor,	6,655	26,775	41,295	8,067	82,926	68,858	1,51,784	14,97,407	21,30,702	3,218,552	7·12	3·24	10·36
	Moradabad,	89,178	31,309	70,196	8,071	1,98,611	1,74,797	3,73,408		21,68,965	3,695,662	18·03	13·60	31·63
	Bareilly,	57,454	25,955	77,095	10,955	1,71,571	23,175	1,94,746	9,89,004	20,93,758	3,313,791	10·38	2·09	12·46
	Shahjehanpur,	69,378	32,917	59,258	10,047	1,71,600	19,647	1,91,247	12,80,999	17,36,047	3,660,182	9·17	1·24	10·42
		19,109	7,209	23,650	5,810	56,318	42,960	1,00,782	12,40,911	20,10,719	3,305,897	5·01	4·17	10·18
	Total,	1,93,159	73,554	2,55,197	82,950	5,80,729	3,53,982	9,34,971	59,36,281	82,57,639	8,195,989	8·07	3·61	14·99
Allahabad.	Mirzapur,	2,555	"	15,178	4,870	22,603	57,553	1,20,156	13,38,559	20,40,525	1,029,120	2·07	2·82	10·68
	Agra,	26,757	23,811	41,330	8,888	1,21,145	58,899	1,80,144	20,20,175	18,07,855	1,189,695	9·15	3·71	12·86
	Furruckabad,	"	18,167	37,470	12,260	71,897	67,953	1,39,851	13,07,301	14,12,252	1,252,257	9·03	4·82	7·85
	Etyapoory,	89,819	19,817	34,611	9,452	1,41,729	56,808	1,78,289	23,79,695	18,38,192	1,265,715	13·63	3·09	13·18
	Etawah,	1,00,998	25,047	42,190	12,351	2,01,786	25,203	2,26,989		13,00,914	1,013,756	15·45	1·94	17·39
	Total,	2,27,731	93,842	2,11,019	48,240	5,71,137	2,25,662	8,00,377	70,45,911	73,82,911	5,799,534	7·60	3·32	11·08
Benares.	Ghazipoor,	53,101	13,210	61,614	13,207	1,41,132	68,113	2,09,245	30,21,956	21,14,098	1,405,520	7·71	3·07	10·78
	Futtehpoor,	5,199	28,617	62,719	9,894	1,06,429	44,757	1,51,186	Included in Allahabad and Goruckpoor.	14,58,819	1,052,838	9·76	3·06	9·82
	Benares, Mirzapoor, Calpee,	72,699	15,893	19,893	5,843	1,08,868	76,963	2,05,677	17,87,891	5,81,485	695,992	19·45	1·32	21·99
		19,755	13,554	34,060	5,248	71,617				5,95,825	613,474	12·13		
		655	14,345	40,906	14,276	1,30,182	92,754	2,22,936	19,40,877	18,62,313	1,442,449	7·13	3·66	13·58
	Jaunpoor,	33,917	14,290	31,698	12,938	1,26,747	67,992	2,01,539	29,20,599	21,20,551	1,792,199	6·31	3·74	9·98
	Total,	1,70,162	1,29,172	3,54,917	61,409	7,06,233	3,54,787	10,61,020	93,93,931	88,75,047	7,579,188	8·33	4·13	12·38
Kumaon.	Gurruckpoor,	77,154	25,545	1,15,519	10,762	2,29,000	2,19,648	4,48,648	7,37,942	20,83,275	2,711,763	10·91	10·26	22·36
	Adjugurh,	35,157	7,731	1,13,378	3,903	1,50,170	4,28,225	5,78,395	Included in Goruckpoor.	14,58,918	1,612,967	9·60	1·60	17·60
	Juanpoor,	52,167	"	42,569	7,161	1,01,719	32,554	1,34,273	17,31,479	19,34,218	993,258	5·11	4·11	13·29
	Mirzapoor,	22,050	22,554	21,317	5,039	71,960	1,21,955	2,93,715	17,31,691	6,83,779	6,240,717	9·13	13·66	22·81
	Benares,	15,522	2,218	20,279	2,723	40,742	89,553	1,30,295		6,84,625	838,633	13·66	4·36	31·22
	Ghazeepoor,	30,660	9,869	23,899	10,834	1,35,260	1,05,519	2,41,139	18,31,521	14,97,939	1,209,961	12·06	8·06	20·72
	Total,	3,27,650	72,547	4,14,960	91,374	9,29,530	9,70,787	19,00,866	60,33,651	90,33,626	12,614,373	10·03	8·21	19·03
						ABSTRACT.								
Dehra.	Dehra,	51,278	"	1,51,940	43,571	3,14,326	73,161	3,87,575	10,75,571	37,93,219	3,405,508	7·71	2·41	10·12
Meerut.	Meerut,	1,26,209	71,266	1,47,672	40,200	4,80,190	1,00,596	5,80,986	52,35,723	81,30,973	8,870,666	6·57	1·23	8·80
Bareilly.	Bareilly,	1,93,159	73,554	2,55,197	82,950	5,80,729	3,53,982	9,34,971	59,36,281	82,57,639	8,195,989	8·07	3·61	14·99
Allahabad.	Allahabad,	2,27,731	93,842	2,11,019	48,240	5,71,137	2,25,662	8,00,377	70,45,911	73,82,911	5,799,534	7·60	3·32	11·08
Benares.	Benares,	1,70,162	1,29,172	3,54,917	61,409	7,06,233	3,54,787	10,61,020	93,93,931	88,75,047	7,579,188	8·33	4·13	12·38
	Kumaon,	3,27,650	72,547	4,14,960	91,374	9,29,530	9,70,787	19,00,866	60,33,651	90,33,626	12,614,373	10·03	8·21	19·03
	Total,	11,95,189	4,70,386	15,65,705	3,91,175	35,72,894	19,57,031	55,29,925	3,73,32,589	1,53,39,921	46,479,253	9·31	4·66	23·97
						A.—Add charges on account of Superintendent of Revenue Surveys, North Western Provinces.	A.	2,42,488						
						B.—Three Survey Generals' Office at the Presidency.	B.	80,515	4,80,000					
						C.—Charged in the Military Accounts at the Presidency.	C.	2,51,998						
							Aggregate,				1,53,39,921	Percentage of the Aggregate on revised Jama. 14·13		

Secretary Board of Revenue, N. W. P.

The 8th August, 1846.

W. MUIR,

Secretary.

No. LIII.

STATISTICAL MEMORANDUM ON THE RESOURCES OF THE MYNPOORIE DISTRICT IN 1849-50;

BY

C. RAIKES, ESQ., C. S.,
Collector of that Zillah.

No. I.—LETTER *No.* 165, *dated 4th April* 1851, *from* W. MUIR, ESQ., C. S., *Secretary to the Sudder Board of Revenue, North Western Provinces, to the address of* J. THORNTON, ESQ., C. S. *Secretary to the Government, North Western Provinces.*

SIR,

Among the reports submitted by the Commissioner of Agra, with his address, upon the Revenue Administration for the year 1849-50, the Board find an interesting memorandum on the resources of the Mynpoorie district, prepared by Mr. C. Raikes. It occurs to them that His Honor may feel interested in this memorandum, for though perhaps not in all respects correct, it is founded upon an ingenious mode of calculation, and exhibits the result of considerable investigation and deduction.

I have, &c.,

W. MUIR,

Secretary.

SUDDER BOARD OF REVENUE,
N. W. P.,
Agra, 4th April 1851.

No. II.—*Memorandum by Mr. Raikes on the resources of Mynpoorie.*

1. I am going to hazard a few remarks, first, on the pecuniary resources of the agricultural population of the Mynpoorie district. Secondly, on the value of the gross produce of the land.

2. I will try first to shew whence the producers get the money with which to pay their land tax, and to purchase clothes, utensils, and other necessaries.

3. To do this I shall take as my guide the annexed table of stock and produce sold at the new gunge at Sirsa during the past year.

4. This gunge absorbs the greater part of the traffic in live stock and produce of the Shekoobad pergunnah, and after some enquiry, I believe I may say that the trade at the gunge represents the average amount of traffic in a tract of 1,13,000 acres of (malgoozaree) land.

5. The cattle dealers take a larger amount of money in the course of the year than all the other dealers put together. But as this trade is mostly between the agricultural producers of the district, who buy from and sell to one another, as may suit their necessities, not much money is got in this way.

6. We must look then to the other market transactions, which may be put down thus—

1st.	District produce sold for export such as wheat, gram, goor, &c., ...	Rs.	1,12,553	0	0
2nd.	District produce sold for district consumption, ...	„	1,14,165	0	0
3rd.	Import from other districts sold for exportation, being goor, ...	„	67,570	0	0
4th.	Imports from other districts sold for district consumption, salt, potatoes, grass, &c., ...	„	29,286	0	0
	Proceeding on these data,	Rs.	3,23,574	0	0

7. The amount sold for exportation and for district consumption representing so far the amount of money taken by producers from non-producers may be estimated thus for the whole district in round numbers—

Exports, ...	Rs.	8,35,000	0	0
Produce sold for district consumption,	„	8,40,000	0	0
Total	Rs.	16,75,000	0	0

8. It is not easy to ascertain the amount taken in return for the produce sold direct to travellers and others, exclusive of that which passes through the larger marts. In the margin* I give a note of the traffic, by wheeled carriages only, through the town of Mynpoorie *towards* Agra during the past year.

* 22913 Carts of 2 Bullocks.
12537 ditto of 3 ditto.
2153 ditto of 4 ditto.
1063 ditto of 5 ditto.
265 ditto of 6 ditto.
43 ditto of 7 ditto.

Total, 38974 Carts.
,, 99255 Bullocks.

9. I cannot estimate the value of produce consumed by travellers and their cattle passing through the district at less than Rs. 2,20,000 per annum, and most of this money finds its way to the agricultural producers. This class also benefits very largely by the expenditure of the State and public departments, which for the past year has amounted to no less than Rs. 6,80,838-8-4½* or about half the sum taken in Land Revenue and Excise from the district. Of this sum at least two-thirds go to the agricultural producers.

Revenue Pay Abstract and Contingencies,	93,975	0	7½
Judicial ditto ditto,	1,51,446	14	2½
Pensions,	4,051	14	4
Military Pay Bills,	87,501	14	8
Bills drawn by Military Officers in charge of Treasuries,	27,297	9	7
Ditto ditto by Political ditto,	2,603	11	10
Ditto ditto by Revenue ditto,	1,83,147	12	8½
Assignments drawn in favor of Officers of the Department of Public Works and Ganges Canal,	1,06,471	14	3
Post Office Department,	3,341	12	2
Road and Ferry Fund,	21,000	0	0
Total Rs.	*6,80,838	8	4½

10. We may then put down the cash receipts of the agricultural population thus—

I.	District produce sold for home consumption	Rs. 8,40,000
II.	Ditto ditto, exportation, ..	,, 8,35,000
III.	Produce sold to petty traders and retailed to travellers and others, ...	,, 2,20,000
IV.	Expended by Government,*	,, 4,44,000
		Rs. 22,39,000

* About Rs. 2,20,713 is value of remittances made by Government Bills in favor of relations of Sepoys.

11. To this must be added the sums brought into the district by men of agricultural families returning from service in foreign States, also the large sums given to the Chowhan Thakoors as dower of females taken in marriage from other districts, and we shall not be far wrong, if we estimate the coin actually touched by the agricultural producers of the district at Rs. 25,00,000.

12. Of this 12,65,953 goes to pay the Government Land Revenue, being, as we may expect, if my calculations are correct, about equal to the sum received for exports* and returned by the expenditure† in the district.

13. There remains a sum of cash in the hands of the cultivating and producing classes equal to about Rs. 12,34,047.

By the best calculation I can make this may be thus disposed of:—

Salt imported,	Rs.	1,05,000
Brass utensils and hard-ware,	„	22,050
Iron,	„	43,750
Balance,	„	10,63,247
Total	Rs.	12,34,047

This balance of Rs. 10,63,247 remains in the district to be turned over for cloth, &c.

14. Besides this amount of the circulating medium, the capital of the agricultural classes may be estimated:—

Cattle,	Rs.	37,14,000
Chattels,	„	2,20,500
Total	Rs.	39,34,500

15. The second question which I proposed to answer was as to the average amount of gross annual produce in the district.

16. Now in a tract which supports more than half a million of people to whom luxury is unknown, and probably not a thousand who do not live in a frugal manner, a tract which produces the necessaries of life in sufficient quantities for a people who import scarcely any foreign edible substance except salt, it is not difficult, if the amount of population be known, to ascertain what the minimum amount of produce in ordinary years must be.

17. The population of the Mynpoorie district is above 650,000. At an average rate of one-half seer of *grain* per head per diem, their consumption must be near thirty lacs of maunds per annum, the money value being, when grain is at 39 seers per rupee, Rs. 39,54,045.

* Rs. 8,35,000 † 4,44,000.

18. The Cattle in the district amounting, as may be easily shewn, to at least* 619,000, consume each

Grain, 5¼ chittacks per diem, worth	Rs.	4	0	0 per annum.
Boosa, 1 seer per diem, worth	,,	1	1	0 ditto.
Grass, ...	,,	0	15	0 ditto.
Average cost per head per annum,	,,	6	0	0

19. On these (very low) calculations, the money value of the produce of the land may be set down

Grain for human consumption, ...	Rs.	39,54,045
Grain for exportation, ...	,,	8,35,000
Grain for cattle, ...	,,	25,02,621
Bhoosa, straw and other fodder, ...	,,	6,77,031
Grass and other spontaneous produce, ..	,,	5,34,348
Total, Rs.		85,03,045

20. By this computation the average yield of every cultivated acre is 350 seers of grain, and this is well known to be about the mark in this district.

21. I have put down these memoranda in the way of "guesses at truth," because I think that the gross produce of the land is generally much undervalued. The sum I have entered is doubtless below the truth, as I have put all my averages low. By the calculation as it stands, the Government demand in this district is only about one-seventh of the gross produce of the land in fair seasons.

C. RAIKES,
Collector.

MYNPOORIE COLLECTOR'S OFFICE,
The 16th July, 1850.

* I assume the cattle at 619,000 *at least* for the following reasons. There are 619,000 cultivated acres requiring for each 20 cutcha beeghs (equal to 4 acres) one pair of bullocks. Now most of these bullocks are bred in the district, and there must be a proportionate number of cows of which very few are killed or exported; add to these cows all buffaloes, male and female, and it is impossible to calculate the cattle lower than this—

Bullocks	309,500
Cows and Buffaloes ..	309,500
	619,000

I propose to test the accuracy of this item by an actual enumeration of the cattle, which is being made.

APPENDIX TO No. II. ON THE RESOURCES OF MYNPOORIE.

Detail of the money price in Rupees of produce sold at the new Gunge at Sirsa in the District of Mynpoorie, from the month of May 1849 to April 1850.

Wheat,	69,635	11	0	Dried Mangoes,	140	15	6
Rice,	18,996	12	0	Castor seed,	754	4	9
Gram,	9,103	7	6	Red Chillies,	396	0	0
Urhur,	5 347	7	0	Oil,	224	3	0
Barley,	10,500	4	6	Garlic,	4	0	0
Maash,	4,119	9	0	Onions,	75	0	0
Goor,	101,055	0	9	Mowhooa,	169	12	0
Salt,	20,958	9	3	Jooar,	4,949	13	6
Moong,	2,893	1	9	Bajra,	3,777	0	9
Sursoo,	5,474	9	0	Mussoor,	368	7	0
Sounf,	202	4	0	Paddy,	80	0	0
Dry Tobacco,	6,609	12	0	Cotton,	2,720	0	0
Smoking Tobacco,	5,850	0	0	Hemp,	4,806	0	0
Reeds,	4,542	0	0	Paddy parched,	292	5	0
Poppy Seeds,	1,904	0	0	Singharah,	4,808	0	0
Khullee Sursoon,	2,345	13	6	Ghee,	697	5	0
Pulse,	5,400	7	0	Moat,	433	0	0
Potatoes,	3,786	0	0	Charcoal,	400	0	0
Ban Moonj,	1,896	0	0	Turmeric,	887	7	9
Cotton Thread,	10,160	0	0	Coriander seed,	737	8	0
Raw Sugar,	3,320	12	0				
Cotton Seed,	2,949	8	0	Total,	3,23,574	12	0

N. B.—Besides this 1,13,048 heads of cattle, viz.

96,118 Bullocks,
4,580 Cows,
650 Female Buffaloes,
8,292 Male ditto,
3,366 Sheep and Goats,
42 Tattoos,

were brought for sale, of which the estimated value of sales completed amount to Rs. 5,11,150.

C. RAIKES,
Collector.

ZILLAH MYNPOORIE, COLLECTOR'S OFFICE,
The 16th July, 1850.

No. LIV.

FINANCIAL RESULT OF REVISION OF SETTLEMENT UNDER REGULATION IX. OF 1833, IN THE NORTH WESTERN PROVINCES.

LETTER No. 472 *of* 1850, *dated 4th October* 1850, *from the Secretary to the Sudder Board of Revenue, addressed to the Secretary to Government, North Western Provinces.*

SIR,

I am directed by the Sudder Board of Revenue, to submit for the information of his Honor the Lieutenant Governor, a comparative Statement, which has been prepared in their Office, showing the financial result of the late revision of Settlement under Regulation IX. of 1833.

2. The demand and collection of land revenue, and the gross income on account of Abkaree and Stamps, have been compared of the Fuslee years 1232—36, and the official years 1842-43—1846-47.

3. The return has been compiled from statements submitted by each Collector; and the principle observed has been to enter the items of the several districts, for each year, precisely as the districts were constituted at the time. A great degree of accuracy has by this process been obtained for the *general* result. But the details are thus rendered less certain for the comparison of the assessment and collections of the several districts, separately, at different periods; because they were subject to decrease or increase by the transfer of villages or pergunnahs. Such changes, it is obvious, do not affect the total returns for each year.

4. It will be observed that the average collections of the five years after the revision of Settlement, exceed those prior to Settlement, by Rs. 17,31,211; but this includes the assessment of resumed maaffee lands, which could not be separated from the khalsa returns.

5. The Board remark, that the increase to the assessment in zillah Goruckpore, forms the principal item of this enhancement of the land revenue.

6. There is also an increase in the Abkaree collections of Rs. 1,30,649, and in the Stamp Department of Rs. 5,00,956.

7. It must be borne in mind that all these returns refer only to the portions of the North Western Provinces, which have been settled under the provisions of Regulation IX. 1833; and that Beyra Dhoon, Kumaon and Bhutteeana, as well as Saugor and the permanently assessed portions of the Benares Division, have been excluded from the computation.

I have, &c.,

W. MUIR,

Secretary.

SUDDER BOARD OF REVENUE, N. W. P.,
Agra, the 4th October, 1850.

STATEMENT SHEWING THE FINANCIAL RESULTS OF THE REVISIONS OF SETTLEMENT IN THE NORTH WESTERN PROVINCES,

By a comparison of the Average Annual Revenue derived in 5 years preceding the Settlement, with that of 5 years subsequent thereto.

DIVISION.	DISTRICT.	Average Annual Revenue for the 5 years from 1282 to 1286 Fusly, i. e., 1874-75 to 1878-79.						Average Revenue of the 5 years 1751-52 to 1855-57.					
		Average of the Total actual Demand of Land Revenue; whether collected by Government or not.	Average of Total Collections on account of Land Revenue.			Average collections on account of Arrears; whether for current or former years.	Average collections on account of Balances; deducting refunds.	Average of the Total actual Demand of Land Revenue; whether collected by Government or not.	Average of Total Collections on account of Land Revenue.			Average collections on account of Arrears; whether for current or former years.	Average collections on account of Balances; deducting refunds.
			Collections on account of current year.	Collections on account of former years.	Collections from lands not on the Tenjee.	Total Land Revenue Collections.			Collections on account of current year.	Collections on account of former years.	Collections from lands not on the Tenjee.	Total Land Revenue Collections.	
Delhi	Panniput,	870,918	840,853	3,110	44,915	888,891	14,779	0	814,719	799,913	0	31,279	831,191	23,330	7,303
	Hissar,	510,894	433,095	1,511	8,805	435,394	2,376	0	422,959	397,191	11,286	28,789	436,267	2,791	3,662
	Delhi,	353,965	322,985	1,930	4,347	327,220	19,919	0	344,912	341,509	1,894	32,751	381,218	66,938	12,169
	Rohtuck,	661,662	601,835	21,491	0	623,326	302	0	629,136	625,547	2,772	821	629,354	1,294	7,219
	Goorgaon,	996,502	663,296	22,002	19,255	905,341	2,242	0	1,033,693	1,029,701	4,282	83	1,033,277	4,290	6,916
	Total,	3,335,169	2,730,657	50,043	66,322	2,947,992	49,618	0	3,245,413	3,193,151	22,233	73,923	3,289,307	97,341	36,270
Meerut	Saharunpore,	1,121,363	1,044,429	15,095	4,911	1,062,433	13,736	33,367	1,032,909	1,003,543	5,794	29,906	1,035,153	21,227	27,569
	Moozuffernuggur,	993,779	961,791	3,350	113	965,457	3,707	4,351	1,047,016	1,019,741	2,653	8,344	1,030,738	15,550	17,378
	Meerut,	1,634,544	1,471,609	3,262	0	1,475,971	40,015	19,362	1,715,114	1,709,443	2,985	3,739	1,716,368	33,422	16,354
	Bulundshuhur,	720,699	715,982	1,286	875	727,993	4,643	8,653	1,042,729	1,040,810	2,060	15,939	1,056,809	7,956	15,617
	Allygurh,	1,345,902	1,329,560	1,079	18,138	1,348,809	13,370	24,999	1,377,255	1,354,509	11,362	7,364	1,373,235	37,553	16,302
	Total,	5,814,347	5,523,370	23,991	23,718	5,481,331	79,196	73,395	6,155,023	6,109,166	24,953	65,292	6,337,503	99,907	130,142
Bareilly	Bijnore,	1,321,519	1,302,606	18,793	1,021	1,322,609	14,369	8,042	1,199,212	1,181,291	15,241	20,721	1,198,231	18,794	23,217
	Moradabad,	1,001,198	998,279	1,634	879	1,002,751	24,529	21,337	1,160,113	1,152,254	8,791	104,671	1,265,716	30,463	31,228
	Bareas,	1,091,433	1,086,674	7,260	807	1,074,441	15,561	7,211	1,107,109	1,091,892	8,182	19,479	1,107,373	16,104	30,098
	Bareilly,	1,091,579	1,089,156	23,455	0	1,112,584	66,659	41,605	1,768,213	1,739,564	5,217	21,839	1,766,620	95,437	34,238
	Shahjehanpore,	1,290,609	1,278,290	4,210	943	1,291,433	57,115	12,139	1,031,659	1,027,176	4,145	519	1,034,279	59,215	19,768
	Total,	5,934,388	5,755,475	55,367	7,452	5,803,494	176,137	130,193	6,004,773	5,913,379	38,318	206,963	6,159,577	237,347	138,349
Agra	Muttra,	0	0	0	0	0	0	0	1,050,672	1,171,099	10,748	13,699	1,195,573	18,701	20,257
	Agra,	2,005,723	1,995,535	19,956	20,054	2,035,545	49,615	30,035	1,595,239	1,522,160	23,035	10,542	1,556,337	35,215	62,549
	Furruckabad,	1,202,010	1,178,309	247	221	1,199,481	74,097	23,459	1,264,421	1,236,746	10,295	13,433	1,254,568	77,339	42,789
	Mynpoory,	1,550,767	1,522,471	9,581	0	1,532,052	35,716	12,954	1,216,752	1,179,145	24,549	0	1,213,695	38,362	16,276
	Etawah,	1,350,643	1,326,209	3,634	0	1,329,914	10,602	4,165	1,278,252	1,247,230	19,725	0	1,266,955	30,370	7,858
	Total,	7,101,173	7,022,524	33,331	20,359	7,096,532	242,509	80,611	7,177,363	6,956,380	128,376	38,609	6,987,668	183,849	139,909
Allahabad	Cawnpore,	3,517,551	3,753,949	3,495	4,077	3,903,521	114,560	43,578	3,130,593	3,117,195	22,551	555	3,140,729	128,472	16,854
	Futtehpore,	1,364,856	1,316,552	10,004	3,167	1,329,666	72,276	12,794	1,433,877	1,419,897	10,903	1,134	1,430,763	38,350	22,417
	Humeerpore,	1,737,502	1,699,753	5,867	0	1,705,220	24,737	14,459	1,253,621	1,252,881	21,832	374	1,257,796	19,313	5,201
	Banda,	1,957,226	1,751,937	19,295	137	1,771,369	61,993	14,314	1,378,256	1,374,523	10,550	14,677	1,399,139	30,497	23,758
	Allahabad,	2,203,026	2,058,175	1,009	20,196	2,079,382	237,444	43,696	2,149,123	2,122,269	3,243	9,963	2,135,475	143,453	71,201
	Total,	10,979,163	9,580,367	43,275	27,719	9,599,491	604,913	128,841	9,395,650	9,286,764	69,033	26,653	9,447,504	379,261	139,429
Benares	Goruckpore,	729,565	710,699	121,291	249	832,239	110,519	93,569	2,014,199	2,004,259	5,873	1,067	2,011,197	193,111	91,339
	Jaunpore,	1,025,451	1,009,555	1,966	17,250	1,028,599	0	0	1,245,815	1,245,459	3,718	0	1,249,178	73,271	10,116
	Total,	1,755,016	1,720,254	123,257	17,499	1,860,837	110,519	93,569	3,260,014	3,249,718	9,591	1,067	3,260,375	266,382	101,455

ABSTRACT SHEWING THE YEARLY DEMAND AND COLLECTIONS, BY DIVISIONS,

For each year of the Quinquennial periods entered in the previous Statement.

DIVISIONS.	Year.	Total actual Demand of Land Revenue; whether confirmed by Government or not.	Total Collections on account of Land Revenue.				Collections on account of Abkaree; whether for current or former years.	Collections on account of Stamps; deducting refunds.
			Collections on account of current year.	Collections on account of former years.	Collections from lands not on the Towjee.	Total Land Revenue Collections.		
Dehlee, Meerut, Rohilcund, Agra, Allahabad and Benares.	1232	34,558,235	32,555,704	256,127	170,397	32,982,228	1,095,438	365,735
	1233	34,394,946	33,416,779	373,753	121,022	33,911,584	971,565	453,608
	1234	34,329,344	33,750,145	449,419	139,083	34,338,650	1,026,943	477,744
	1235	34,007,653	33,447,554	255,688	157,843	33,921,085	1,078,911	423,074
	1236	33,155,109	32,017,288	353,630	281,695	32,652,613	1,116,547	430,755
		170,445,287	165,187,473	1,715,647	900,040	167,806,160	5,289,404	2,150,916
Average, ..	....	34,089,657	33,037,495	343,729	180,008	33,561,232	1,057,881	430,183
Dehlee, Meerut, Rohilcund, Agra, Allahabad and Benares.	1842-43	35,728,942	34,048,365	370,604	502,488	34,921,457	1,041,744	899,253
	1843-44	35,940,967	34,405,047	367,658	406,574	35,179,279	1,086,217	907,353
	1844-45	35,661,015	34,412,388	269,468	415,462	35,127,318	1,230,165	894,065
	1845-46	35,633,230	34,907,568	252,724	314,101	35,474,393	1,280,570	935,698
	1846-47	35,627,149	33,224,308	260,098	275,366	33,759,772	1,303,449	1,018,626
		178,591,312	172,997,676	1,520,552	1,913,991	176,462,219	5,942,145	4,655,695
Average, ..	....	35,718,262	34,599,535	304,110	382,798	35,292,443	1,188,429	931,139

W. MUIR,

Secretary.

Sudder Board of Revenue, N. W. P.,
Agra, the 4th October, 1850.

No. LVI.

REPORT UPON THE TEA PLANTATIONS IN THE NORTH WESTERN PROVINCES.

REPORT *upon the Tea Plantations of Deyra, Kumaon and Gurhwal, by* ROBERT FORTUNE, ESQ., *addressed to* JOHN THORNTON, ESQ., *Secretary to the Government, North Western Provinces, dated Calcutta, September 6th,* 1851.

SIR,

Having inspected the whole of the Government and Zemindaree Tea plantations in Gurhwal and Kumaon, in compliance with the orders of the Honorable the Lieutenant Governor North Western Provinces, sanctioned by the Most Noble the Governor General of India, I have now the honor to transmit my Report upon the condition of these plantations, and upon the future prospects of Tea cultivation in the Himalayas. I have also suggested some improvements in the cultivation and manufacture, which I have been able to do from experience gained during a long residence in China, and which I believe to be of great importance.

I have, &c.,
ROBT. FORTUNE.

REPORT UPON THE TEA PLANTATIONS IN THE NORTH WESTERN PROVINCES.

Kaolagir Tea Plantation.

1. *Situation and Extent.*—The Deyra Doon, or Valley of Deyra, is situated in latitude 30° 18′ north, and in longitude 78° east. It is about 60 miles in length from east to west, and 16 miles broad at its widest part. It is bounded on the south by the Sewalick range of hills, and on the north by the Himalayas proper, which are here nearly 8,000 feet above the level of the sea. On the west it is open to the river Jumna, and on the east to the Ganges, the distance between these rivers being about 60 miles.

In the centre of this flat valley, the Kaolagir tea plantation has been formed. Eight acres were under cultivation in 1847. There are now 300 acres planted, and about 90 more taken in and ready for many thousands of young plants raised lately from seeds in the plantation.

2. *Soil and Culture.*—The soil of this plantation is composed of clay, sand, and vegetable matter, rather stiff and apt to get "baked" in dry weather, but free enough when it is moist or during the rains. It rests upon a gravelly subsoil, consisting of limestone, sandstone, clay-slate, and quartz rock, or of such rocks as enter into the composition of the surrounding mountain ranges. The surface is comparatively *flat*, although it falls in certain directions towards the ravines and rivers.

The plants are arranged neatly in rows 5 feet apart, and each plant is about 4½ feet from its neighbour in the row. A long rank-growing species of grass indigenous to the Doon, is most difficult to keep from over-topping the tea plants, and is the cause of much extra labour. Besides the labour common to all tea countries in China, such as weeding, and occasionally loosening the soil, there is here an extensive system of irrigation carried on. To facilitate this, the plants are planted in trenches, from four to six inches below the level of the ground, and the soil thus dug out is thrown between the rows to form the paths. Hence the whole of the plantation consists of numerous trenches of this depth, and five feet from centre to cen-

tre. At right angles with these trenches a small stream is led from the canal, and by opening or shutting their ends irrigation can be carried on at the pleasure of the Overseer.

3. *Appearance and health of Plants.*—The plants generally did not appear to me to be in that fresh and vigorous condition which I had been accustomed to see in good Chinese plantations. This, in my opinion, is caused, 1st, by the plantation being formed on *flat land*; 2nd, by the system of *irrigation*; 3rd, by too early plucking; and 4th, by hot drying winds, which are not unfrequent in this valley from April to the beginning of June.

GUDDOWLI PLANTATION, (NEAR PAORIE).

1. *Situation and Extent.*—This plantation is situated in the Province of Eastern Gurhwal, in latitude 30° 8′ north, and in longitude 78° 45′ east. It consists of a large tract of terraced land, extending from the bottom of a valley or ravine to more than 1,000 feet up the sides of the mountain. Its lowest portion is about 4,300 feet, and its highest 5,300 feet above the level of the sea: the surrounding mountains appear to be from 7,000 to 8,000. The plantation has not been measured, but there are, apparently, fully one hundred acres under cultivation.

There are about 500,000 plants already planted, besides a large number of seedlings in beds ready for transplanting. About 3,400 of the former were planted in 1844 and are now in full bearing; the greater portion of the others are much younger, having been planted out only one, two and three years.

2. *Soil and Culture.*—The soil consists of a mixture of loam, sand, and vegetable matter, is of a yellow colour, and is most suitable for the cultivation of the tea plant. It resembles greatly the soil of the best tea districts in China. A considerable quantity of stones are mixed with it, chiefly small pieces of clay-slate, of which the mountains here are composed. Large tracts of equally good land, at present covered with jungle, are available in this district without interfering in any way with the rights of the settlers.

I have stated that this plantation is formed on the hill side. It consists of a succession of terraces, from the bottom to the top, on which the tea bushes are planted. In its general features it is very like a Chinese tea plantation, although one rarely sees tea lands terraced in China. This, however, may be necessary in the Himalayas where the rains fall so heavily. Here too the system of irrigation is carried on, although to a small extent only, owing to the scarcity of water during the dry season.

3. *Appearance and health of Plants.*—This plantation is a most promising one, and I have no doubt will be very valuable in a few years. The plants are growing admirably, and evidently like

their situation. Some of them are suffering slightly from the effects of hard-plucking, like those at Kaolagir; but this can easily be avoided in their future management. Altogether, it is in a most satisfactory condition, and shews how safe it is in matters of this kind to follow the example of the Chinese cultivator, who never makes his tea plantations on *low rice land* and *never irrigates*.

Hawulbaugh Plantation, (near Almorah).

1*st*. *Situation and Extent*.—This tea farm is situated on the banks of the river Kosilla, about 6 miles north-west from Almorah, the capital of Kumaon. It is about 4,500 feet above the level of the sea. The land is of an undulating character, consisting of gentle slopes and terraces, and reminded me of some of the best tea districts in China. Indeed, the hills themselves, in this part of the Himalayas, are very much like those of China, being barren near their summit and fertile on their lower sides.

Thirty-four acres of land are under tea cultivation here, including the adjoining farm of Chullar. Some of the plants appear to have been planted in 1844; but, as at Paorie, the greater number are only from one to three years old.

2*nd*. *Soil and Culture*.—The soil is what is usually called a sandy-loam; it is moderately rich, being well mixed with vegetable matter. It is well suited for tea cultivation. The greater part of the farm is terraced as at Guddowli, but some few patches are left in natural slopes in accordance with the Chinese method. Irrigation is practised to a limited extent.

3*rd*. *Appearance and health of Plants*.—All the young plants here are in robust health and are growing well, particularly where they are growing on land where water cannot flood or injure them. As examples of this, I may point out a long belt between Dr. Jameson's house and the flower garden, and also a piece of ground a little below the houses in which the Chinese manufacturers live. Some few of the older bushes appear rather stunted; but this is evidently the result of water remaining stagnant about their roots, and partly also of over-plucking; both defects, however, admit of being easily cured.

Lutchmisser and Kuppeena Plantations.

1*st*. *Situation and Extent*.—These plantations are on the hill side near Almorah, and about 5,000 feet above the level of the sea. The situation is somewhat steep, but well adapted to the growth of tea. The former contains three acres, and the latter four acres under cultivation.

2*nd*. *Soil and Culture*.—The soil is light and sandy, and much mixed with particles of clay-slate, which have crumbled down

from the adjoining rocks. I believe these plantations are rarely irrigated, and the land is steep enough to prevent any stagnant water from remaining about the roots of the plants.

3rd. *Appearance and health of Plants.*—Most of the bushes here are fully grown, and in full bearing, and generally in good health. On the whole, I consider these plantations in excellent order.

Bheemtal Plantations.

The lake of Bheemtal is situated in latitude 29° 20′ north, and in longitude 79° 30′ east. It is 4,000 feet above the level of the sea, and some of the surrounding mountains are said to be 8,000 feet. These form the southern chain of the Himalayas, and bound the vast plain of India, of which a glimpse can be had through the mountain passes. Amongst these hills there are several *tals* or lakes, some flat meadow-looking land, and gentle undulating slopes, while higher up we have steep and rugged mountains. It is amongst these hills, that the Bheemtal tea plantations have been formed. They may be classed under three heads, viz.

1st. *Anoo and Kooasur Plantations.*—These adjoin each other, are both formed *on low flat land*, and together cover about 46 acres. The plants do not seem healthy or vigorous; many of them have died out, and few are in that state which tea plants ought to be in. Such situations never ought to be chosen for tea cultivation. The same objection applies to these as to those at Deyra, but in a greater degree. No doubt, with sufficient drainage, and great care in cultivation, the tea plant might be made to exist in such a situation; but I am convinced it would never grow with that luxuriance which is necessary in order to render it a profitable crop. *Besides, such lands are valuable for other purposes.* They are excellent rice lands, and as such of considerable value to the natives.

2nd. *Bhurtpoor Plantation.*—This plantation covers about 4½ acres of terraced land on the hill side, a little to the eastward of those last noticed. The soil is composod of a light loam, much mixed with small pieces of clay-slate and trap or green-stone, of which the adjacent rocks are composed. It contains also a small portion of vegetable matter or *humus*. Both the situation and soil of this plantation are well-adapted to the requirements of the tea shrub, and consequently we find it succeeding here as well as at Gud-dowli, Hawulbaugh, Almorah, and other places where it is planted on the slopes of the hills.

3rd. *Russia Plantation.*—This plantation extends over 75 acres, and is formed on sloping land. The elevation is somewhat less than Bhurtpoor, and although terraced in the same way, the angle is much lower. In some parts of the farm the plants are doing well, but generally they seemed to be suffering from too much

water and hard plucking. I have no doubt, however, of the success of this farm, when the system of cultivation is improved. I observed some most vigorous and healthy bushes in the Overseer's garden, a spot adjoining the plantation, which could not be irrigated, and was informed they "never received any water, except that which fell from the skies."

In the Bheemtal district, there are large tracts of excellent tea land. In crossing over the hills towards Nainee Tal, with J. H. Batten, Esq., Commissioner of Kumaon, I pointed out many tracts admirably adapted for tea cultivation, and of no great value to the natives; generally, those lands on which the mundooa is cultivated are the most suitable.

I have thus described all the Government plantations in Gurhwal and Kumaon. Dr. Jameson, the Superintendent, deserves the highest praise for the energy and perseverance with which he has conducted his operations. I shall now notice the plantations of the zemindars, under the superintendence of the Commissioner and Assistant Commissioner of Kumaon and Gurhwal.

ZEMINDAREE TEA PLANTATIONS.

1*st, at Lohba.*—This place is situated in eastern Gurhwal, about 50 miles to the westward of Almorah, and is at an elevation of 5,000 feet above the level of the sea. It is one of the most beautiful spots in this part of the Himalayas. The surrounding mountains are high, and in some parts precipitous, while in others they are found consisting of gentle slopes and undulations. On these undulating slopes, there is a great deal of excellent land suitable for tea cultivation. A few tea bushes have been growing vigorously for some years in the Commissioner's garden, and they are now fully ten feet in height. These plants having succeeded so well, naturally induced the authorities of the province to try this cultivation upon a more extensive scale. It appears that in 1844, about 4,000 young plants were obtained from the Government plantations, and planted on a tract of excellent land, which the natives wished to abandon. Instead of allowing the people to throw up their land, they were promised it rent-free upon the condition that they attended to the cultivation of the tea, which had been planted on a small portion of the ground attached to the village.

This arrangement seems to have failed, either from want of knowledge, or from design, or perhaps partly from both of these causes. More lately, a larger number of plants have been planted, but I regret to say with nearly the same results.

But results of this discouraging kind are what any one, acquainted with the nature of the tea plant, could have easily foretold, had the treatment, intended to be given it, been explained to him.

Upon enquiry, I found the villagers had been managing the tea lands just as they had been doing their rice fields, that is a regular system of irrigation was practised. *As water was plentiful*, a great number, indeed nearly all, the plants seem to have perished from this cause. The last planting alluded to had been done late in the spring, and just at the commencement of the dry weather, and to these plants little or no water seems to have been given. So that in fact it was going from one extreme to another equally bad, and the result was of course nearly the same.

I have no hesitation in saying that the district in question is well adapted for the cultivation of tea. With judicious management, a most productive farm might be established here in four or five years. Land is plentiful, and of little value either to the natives or to the Government.

2nd, at Kutoor.—This is the name of a large district 30 or 40 miles northward from Almorah, in the centre of which the old town or village of Byznath stands. It is a fine undulating country consisting of wide valleys, gentle slopes, and little hills, while the whole is intersected by numerous streams, and surrounded by high mountains. The soil of this extensive district is most fertile, and is capable of producing large crops of rice, on the low irrigable lands, and the dry grains and tea on the sides of the hills. From some cause however, either the thinness of population or *the want of a remunerative crop*,* large tracts of this fertile district have been allowed to go out of cultivation. Every where I observed ruinous and jungle-covered terraces, which told of the more extended cultivation of former years.

Amongst some hills near the upper portion of this district, two small tea plantations have been formed under the patronage and superintendence of Captain Ramsay, Senior Assistant Commissioner of Kumaon. Each of them cover three or four acres of land, and had been planted about a year before the time of my visit. In this short space of time, the plants had grown into nice strong bushes, and were in the highest state of health. I never saw, even in the most favoured districts in China, any plantations looking better than these. This result, Captain Ramsay informed me, had been attained in the following simple manner. All the land attached to the two villages with which the tea farms are connected, is exempted from the revenue tax, a sum amounting only to Rs. 52 per annum. In lieu of this, the assamees (cultivators) of both villages assist with manure,

* The crops of this district, such as rice, mundooa and other grains, are so plentiful and cheap as scarcely to pay the carriage to the nearest market town, much less to the plains. In Almorah a maund of rice or mundooa sells for something less than a rupee, barley for eight annas, and wheat for a rupee.

and at the transplanting season, as well as ploughing and preparing fresh land. In addition to this, one chowdree and four prisoners are constantly employed upon the plantations. The chief reason of the success of these plantations, next to that of the land being well suited for tea cultivation, may, no doubt, be traced to a good system of management: that is, the young plants have been carefully transplanted at the proper season of the year, when the air was charged with moisture, and they have not been destroyed by excessive irrigation afterwards. The other zemindaree plantation at Lohba might have been now in full bearing had the same system been followed.

From the description thus given, it will be observed that I consider the Kutoor plantations in a most flourishing condition. And I have no doubt they will continue to flourish, and soon convince the zemindars of the value of tea cultivation, providing three things intimately connected with the success of the crop are strongly impressed upon their minds; viz., the unsuitableness of low wet lands for tea cultivation; the folly of irrigating tea as they would do rice; and the impropriety of commencing the plucking before the plants are strong and of considerable size. It is difficult in a Report to give an idea of the proper time to begin plucking, but I have explained my views upon the subject fully to Dr. Jameson and to Captain Ramsay. I am happy to add that amongst these hills there are no foolish prejudices in the minds of the natives against the cultivation of tea. About the time of my visit a zemindar came and begged two thousand plants to enable him to commence tea growing on his own account.

It is of great importance, that the authorities of a district and persons of influence, should shew an interest in a subject of this kind. At present the natives do not know its value, but they are as docile as children, and will enter willingly upon tea cultivation providing the "sahib" shews that he is interested in it. In a few years the profits received will be a sufficient inducement.

In concluding this part of my Report, I beg to suggest the propriety of obtaining some of the *best varieties* of the tea plant which have been introduced lately into the Government plantations from China. Dr. Jameson could no doubt spare a few, but they ought to be given to those zemindars only who have succeeded with the original variety.

Having described in detail the various Government plantations, and also those of the zemindars which came under my notice in the Himalayas, I shall now make some general remarks upon the cultivation of tea in India, and offer some suggestions for its improvement.

General Remarks.

1. *On Land and Cultivation.*—From the observations already made upon the various tea farms which I have visited in the Himalayas, it will be seen that I do not approve of *low flat lands* being selected for the cultivation of the tea shrub. In China, which at present must be regarded as the model tea country, the plantations are never made in such situations, or they are so rare as not to have come under my notice. In that country they are usually formed on the lower slopes of the hills, that is, in such situations as those at Guddowli, Hawulbaugh, Almorah, Kutoor, &c., in the Himalayas. It is true that in the fine green tea country of Hwuychow, in China, near the town of Tun-che, many hundred acres of flattish land are under tea cultivation. But this land is close to the hills, which jut out into it in all directions, and it is intersected by a river whose banks are usually from 15 to 20 feet above the level of the stream itself, not unlike those of the Ganges below Benares. In fact, it has all the advantages of hilly land such as the tea plant delights in. In extending the Himalaya plantation this important fact ought to be kept in view.

There is no scarcity of such land in these mountains, more particularly in Eastern Gurhwal and Kumaon. It abounds in the districts of Paorie, Kunour, Lohba, Almorah, Kutoor, and Bheemtal, and I was informed by Mr. Batten that there are large tracts about Gungoli and various other places equally suitable. Much of this land is out of cultivation, as I have already stated, while the cultivated portions yield on an average only two or three annas per acre of revenue.

Such lands are of less value to the zemindars than low rice land where they can command a good supply of water for irrigation. But I must not be understood to recommend poor worn out hill lands for tea cultivation,—land on which nothing else will grow. Nothing is further from my meaning. Tea in order to be profitable requires a good sound soil,—a light loam, well mixed with sand and vegetable matter, moderately moist, and yet not stagnant or sour. Such a soil, for example, as on these hill sides produces good crops of mundooa, wheat or millet, is well adapted for tea. It is such lands which I have alluded to as abounding in the Himalayas, and which are, at present, of so little value either to the Government, or to the natives themselves.

The system of irrigation applied to tea in India is never practised in China. I did not observe it practised in any of the great tea countries which I visited. On asking the Chinese manufacturers whom I brought round, and who had been born and brought up in these districts, whether they had seen such a practice, they all replied, " *no, that is the way we grow rice ; we*

never irrigate tea." Indeed, I have no hesitation in saying that, in nine cases out of ten, the effects of irrigation are most injurious. When tea will not grow without irrigation, it is a sure sign that the land employed is not suitable for such a crop. It is no doubt an excellent thing to have a command of water in case of a long drought, when its agency might be useful in saving a crop which would otherwise fail, but irrigation ought to be used only in such emergent cases.

I have already observed that good tea land is naturally moist, although not stagnant; and we must bear in mind that the tea shrub is *not a water plant*, but is found in a wild state on the sides of hills. In confirmation of these views, it is only necessary to observe further, that all the *best Himalayan plantations are those to which irrigation has been most sparingly applied.*

In cultivating the tea shrub, much injury is often done to a plantation by *plucking leaves from very young plants.* In China young plants are never touched until the third or fourth year after they have been planted. If growing under favourable circumstances, they will yield a good crop after that time. All that ought to be done, in the way of plucking or pruning before that time, should be done with a view to *form the plants*, and make them *bushy* if they do not grow so naturally. If plucking is commenced too early and continued, the energies of the plants are weakened, they are long in attaining any size, and consequently there is a great loss of produce in a given number of years. To make this more plain, I will suppose a bush that has been properly treated to be eight years of age. It may then be yielding from two to three pounds of tea per annum, while another of the same age, but not a quarter of the size, from over-plucking, is not giving more than as many ounces.

The same remarks apply also to plants which become unhealthy from any cause; leaves ought never to be taken from such plants; the gatherers should have strict orders to pass them over until they get again into a *good state* of health.

2nd. On climate.—I have already stated that eastern Gurhwal and Kumaon appear to me to be the most suitable for the cultivation of the tea plant in this part of the Himalayas. My remarks upon climate will therefore refer to this part of the country.

From a table of temperature kept at Hawulbaugh from November 28th 1850, to July 13th 1851, obligingly furnished me by Dr. Jameson, I observe that the climate here is extremely mild. During the winter months, the thermometer (Fahr.) at sunrise was never lower than 44°, and only on two occasions so low, namely on the 15th and 16th of February 1851. Once it stood so high as 66° on the morning of February the 4th, but this is full ten

degrees higher than usual. The minimum in February must, however, be several degrees lower than is shewn by this table, for ice and snow are not unfrequent; indeed, opposite the 16th of February in the column of remarks, I find written down *a very frosty morning*. This discrepancy no doubt arises either from a bad thermometer being used, or from its being placed in a sheltered verandah. We may, therefore, safely mark the minimum as 32° instead of 44°.

The month of June appears to be the hottest in the year. I observe the thermometer on the 5th, 6th and 7th of that month stood at 92° at 3 P. M., and this was the highest degree marked during the year. The lowest, at this hour, during the month was 76°, but the general range in the 3 P.M. column of the table is from 80° to 90°.

The wet and dry seasons are not so decided in the hills as they are in the plains. In January 1851, it rained on five days and ten nights, and the total quantity of rain which fell, as indicated by the rainguage, during this month was 5·25 inches; in February 3·84 fell; in March 2·11; in April 2·24; in May none; and in June 6·13. In June there are generally some days of heavy rain, called by the natives Chota Bursaut or small rains, after this there is an interval of some days of dry weather before the regular "rainy season" commences. This season comes on in July and continues until September. October and November are said to be beautiful months with a clear atmosphere and cloudless sky. After this fogs are frequent in all the valleys until spring.

In comparing the climate of these provinces with that of China, although we find some important difference, yet upon the whole there is a great similarity. My comparisons apply, of course, to the best tea districts only, for although the tea shrub is found cultivated from Canton in the south to Tan-chow-poo in Shan-tung, yet the provinces of Fokein, Kiansee and the southern parts of Kiang-nan yield nearly all the finest teas of commerce.

The town of Tsong-gan, one of the great black tea towns near the far-famed Woo-e-shan, is situated in latitude 27° 47′ north. Here the thermometer in the hottest months, namely in July and August, rarely rises above 100° and ranges from 92° to 100° as maximum; while in the coldest months, December and January, it sinks to the freezing point and sometimes a few degrees lower. We have thus a close resemblance in temperature between Woo-e-shan and Almorah. The great green tea district being situated two degrees further north, the extremes of temperature are somewhat greater. It will be observed, however, that while the hottest month in the Himalayas is June, in China the highest temperature occurs in July and August: this is owing to the rainy season taking place earlier in China than it does in India.

In China rain falls in heavy and copious showers in the end of April, and these rains continue at intervals in May and June. The first gathering of tea-leaves, those from which the Pekoe is made, is scarcely over before the air becomes charged with moisture, rain falls, and the bushes being thus placed in such favourable circumstances for vegetating are soon covered again with young leaves, from which the main crop of the season is obtained.

No one, acquainted with vegetable physiology, can doubt the advantages of such weather in the cultivation of tea for mercantile purposes. And these advantages, to a certain extent at least, seem to be extended to the Himalayas, although the regular rainy season is later than in China. I have already shewn from Dr. Jameson's table, that spring showers are frequent in Kumaon, although rare in the plains of India; still, however, I think it would be prudent to adapt the gathering of leaves to the climate, that is to take a moderate portion from the bushes before the rains, and the main crop after they have commenced.

3rd. On the Vegetation of China and the Himalayas.—One of the surest guides from which to draw conclusions, on a subject of this nature, is found in the indigenous vegetable productions of the countries. Dr. Royle, who was the first to recommend the cultivation of tea in the Himalayas, drew his conclusions, in the absence of that positive information from China which we possess now, not only from the great similarity in temperature between China and these hills, but also from the resemblance in vegetable productions. This resemblance is certainly very striking. In both countries, except in the low valleys of the Himalayas (and these we are not considering) tropical forms are rarely met with. If we take trees and shrubs, for example, we find such genera, as pinus, cypress, berberis, quercus, viburnam, indigofera, andromeda, lonicera, deutzia, rubus, myrica, spiræa, ilex, and many others common to both countries.

Amongst herbaceous plants we have gentiana, aquilegia, anemone, rumex, primula, lilium, leontodon, ranunculus, &c. equally distributed in the Himalayas and in China, and even in aquatics the same resemblance may be traced, as in nelumbium, caladium &c. And further than this, we do not find plants belonging to the same genera only, but in many instances the identical species are found in both countries. The indigofera, common in the Himalayas, abounds also on the tea hills of China, and so does berberis nepaulencis, lonicera diversifolia, myrica sapida,* and many others.

* The Chinese have a fine variety of this fruit which ought by all means to be introduced to the Himalayas. It is as large as an Orleans plum, and as superior to the Indian one as the apple is to the crab. It would be a great luxury to the poor. GRAFTED PLANTS must be procured.

The variety of the Bamboo, common about temples on the tea hills of China, would also be of much value in India, where there is nothing to be compared to them.

Were it necessary, I might now shew that there is a most striking resemblance between the geology of the two countries as well as in their vegetable productions. In both the black and green tea countries which I have alluded to, clay-slate is most abundant. But enough has been advanced to prove how well many parts of the Himalayas are adapted for the cultivation of tea; besides, the flourishing condition of many of the plantations is, after all, the best proof, and puts the matter beyond all doubt.

4th. *Concluding Suggestions.*—Having shewn that tea can be grown in the Himalayas, and that it would produce a valuable and remunerative crop, the next great object appears to be the production of superior tea, by means of fine varieties and improved cultivation. It was well known that a variety of the tea plant existed in the southern parts of China from which inferior teas only were made. That, being more easily procured than the fine northern varieties, from which the great mass of the best teas are made, was the variety originally sent to India. From it all those in the Government plantations have sprung.

It was to remedy this, and to obtain the best varieties from those districts which furnish the trees of commerce, that induced the Honorable Court of Directors to send me to China in 1848. Another object was to obtain some good manufacturers and implements from the same districts. As the result of this Mission, nearly twenty thousand plants from the best black and green tea countries of Central China have been introduced to the Himalayas. Six first-rate manufacturers, two lead-men, and a large supply of implements from the celebrated Hwuychow districts were also brought round and safely located on the Government plantations in the hills.

A great step has thus been gained towards the objects in view. Much, however, remains still to be done. The new China plants ought to be carefully propagated and distributed over all the plantations; some of them ought also to be given to the zemindars, and more of these fine varieties might be yearly imported from China.

The Chinese manufacturers, who were obtained some years since from Calcutta or Assam, are, in my opinion, far from being first-rate workmen; indeed, I doubt much if any of them learned their trade in China. They ought to be gradually got rid of and their places supplied by better men, for it is a great pity to teach the natives an inferior method of manipulation. The men brought round by me are first-rate green tea makers, they can also make black tea, but they have not been in the habit of making so much black as green. They have none of the Canton illiberality or prejudices about them, and are most willing to teach their art to the natives. I have no doubt some of the latter will soon be made excel-

lent tea manufacturers. And the instruction of the natives is, no doubt, one of the chief objects which ought to be kept in view, for the importation of Chinese manipulators at high wages can only be regarded as a temporary measure; ultimately the Himalayan tea must be made by the natives themselves; each native farmer must learn how to make tea as well as how to grow it; he will then make it upon his own premises, as the Chinese do, and the expences of carriage will be much less than if the green leaves had to be taken to the market.

But as the zemindars will be able to grow tea long before they are able to make it, it would be prudent in the first instance to offer them a certain sum for green leaves brought to the Government manufactory.

I have pointed out the land most suitable for the cultivation of tea, and shewn that such land exists in the Himalayas to an almost unlimited extent. But if the object the Government have in view be the establishment of a company to develope the resources of these hills as in Assam, I would strongly urge the propriety of concentrating, as much as possible, the various plantations. Sites ought to be chosen which are not too far apart, easy of access and if possible near rivers; for, no doubt, a considerable portion of the produce would have to be conveyed to the plains or to a sea port.

In my tour amongst the hills, I have seen no place so well adapted for a central situation as Almorah or Hawulbaugh. Here the Government has already a large establishment, and tea lands are abundant in all directions. The climate is healthy, and better suited to a European constitution than most other parts of India. Here plants from nearly all the temperate parts of the world are growing as if they were at home. As examples, I may mention myrtles, pomegranates, and tuberoses from the south of Europe; dahlias, potatoes, aloes, and yuccas from America; melianthus major and bulbs from the Cape; the cypress and deodar of the Himalayas; and the lagerstræmias, loquats, roses and tea of China.

In these days, when tea has become almost a necessary of life to England and her wide-spreading Colonies, its production upon a large and cheap scale is an object of no ordinary importance. But to the natives of India themselves, the production of this article would be of the greatest value. The poor *puharie*, or hill farmer, at present, has scarcely the common necessaries of life, and certainly none of its luxuries. The common sorts of grain which his lands produce will scarcely pay the carriage to the nearest market-town, far less yield a profit of such a kind as will enable him to purchase some few of the necessary and simple luxuries of life. A common blanket has to serve him for his covering by day and for his bed at night, while his dwelling house is

a mere mud-hut capable of affording but little shelter from the inclemency of the weather. Were part of these lands producing tea he would then have a healthy beverage to drink, besides a commodity which would be of great value in the market. Being of small bulk compared with its value, the expense of carriage would be trifling, and he would return home with the means in his pocket of making himself and his family more comfortable and more happy.

Were such results doubtful, we have only to look across the frontiers of India into China. Here we find tea one of the necessaries of life in the strictest sense of the word. A Chinese never drinks cold water, which he abhors, and considers unhealthy. Tea is his favourite beverage from morning until night; not what we call tea, mixed with milk and sugar, but the essence of the herb itself drawn out in pure water. One acquainted with the habits of this people can scarcely conceive the idea of the Chinese Empire existing were it deprived of the tea plant; and I am sure that the extensive use of this beverage adds much to the health and comfort of the great body of the people.

The people of India are not unlike the Chinese in many of their habits. The poor of both countries eat sparingly of animal food, and rice with other grains and vegetables form the staple articles on which they live; this being the case it is not at all unlikely the Indian will soon acquire a habit which is so universal in the sister country. But in order to enable him to drink tea, it must be produced at a cheap rate; he cannot afford to pay at the rate of four or six shillings a pound. It must be furnished to him at four *pence* or six *pence* instead, and this can be done easily, but only on his own hills. If this is accomplished, and I see no reason why it should not be, a boon will have been conferred upon the people of India, of no common kind, and one which an enlightened and liberal Government may well be proud of conferring on its subjects.

ROBERT FORTUNE.

No. LVII.

REPORT ON THE DIFFERENT KINDS OF WOOD, PROCURABLE ON THE LINES OF THE AGRA AND BOMBAY ROAD, AND THE GREAT DECCAN ROAD.

Extract Paragraphs 1 *to* 3 *of a Letter from the* SUPERINTENDING ENGINEER *of the Central Provinces to the* OFFICIATING SECRETARY *to the* MILITARY BOARD, *Fort William, No.* 352, *dated the* 14*th June* 1851.

1. I have the honor to inform you that I have on the 21st ultimo, forwarded for the purpose of being despatched by steamer from Allahabad, a box containing specimens of wood of such kinds in the neighbourhood of the Agra and Bombay Road as may be deemed fit to be subjected to scrutiny, chemically and otherwise, comparatively with saul and teak, with a view of testing their merits for employment in the construction of Lattice Bridges. A tabular statement accompanies this letter, detailing the nature and description of the wood, where found, and the uses to which they are put by the natives, with such other information as may be deemed necessary to enable a judgment to be passed on their merits.

2. This communication has reference to the 45th paragraph of my Report on that Road, No. 2078, dated the 24th February 1851; and as there are several localities which I have detailed in that Report, where these bridges might be advantageously employed, the subject is worthy of consideration.

3. The "muhwa" and "khowra," but especially the former, are abundant, and used for such purposes as show their adaptability to these kinds of bridges; and I have little doubt, but that if seasoned properly and saturated with the chloride of zinc or sulphate of copper, would be found a valuable material for the purposes I allude to.

Statement of Timbers procurable on the Agra and Bombay Road, Great Deccan Road, Gwalior and Cawnpore Divisions of Public Works.

Name of Wood.	*Where found.*	*Division.*	*Nature and Properties.*	Remarks.
Khowra, ..	(No. V.) Dark color, between Seepree and Indore.	Gwalior. ..	Close grained, hard, tough, not liable to bend.	The khowra is used extensively for beams, planks and felloes of wheels, between Ragoogurh and Puchore. Timbers of 20 feet can be obtained only after enquiry, but smaller timbers of 12 and 15 feet can be procured easily. Planks, for bridge building, 12 feet in length, by 12 inches in breadth and 3 inches in thickness, will cost, on an average, one rupee each, including all expenses.
Sadhir, ..	(No. VIII.) Around Sarungpoor, Augur and Indore.	Ditto.	More flexible than mubwa or khowra, and a lighter wood.	This is almost the only wood used for beams around Sarungpoor, Augur and Indore, but as it is a lighter wood as well as cheaper than the muhwa or khowra, additional stiffness should be obtained at the same expense by encrease of scantling.
Muhwa, ..	(No. II.) Seepree and Indore,	Ditto.	It is hard, durable, tough, strong and cheap. When freshly cut, it bends very much; but a well seasoned timber is almost inflexible.	It is difficult to obtain muhwa timbers of any great length, and when obtained, the timbers are always of small scantling. But 3-inch planks, 12 feet long by 10 inches in breadth, more or less, can be procured at an average price of one rupee each,—felling, squaring and carriage included. For bridge purposes, I consider the old red muhwa is the best timber procurable along the Bombay road from Seepree to Indore.

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Statement of Timbers procurable on the Agra and Bombay Road, Great Deccan Road, Gwalior and Cawnpore Divisions of Public Works.—(Continued).

No.	Name of Wood.	Where found.	Division.	Nature and Properties.	Remarks.
8	Muhwa, ..	In the Budowrah Sirsee Mow, and other Forests.	Agra and Bombay Road.	It is of a tough, and durable nature.	This wood is plentiful. Seasoning in water is advisable. Roof timbers or kurrees of this wood have lasted 100 and 150 years. Scantlings varying in diameter from 9" to 3' and 4', and may be purchased from 1 to 6 rupees per tree. The fruit of this tree gives a fair annual return to the zemindars; consequently objections may be made to fell trees, length from 15 to 20 feet.
	Ditto, ..	Is found all over the southern portion of Bundlekund.	7th or Cawnpore Division.	Is reckoned the next best wood to saul wood.	Is found in greater or less quantities all over the southern portion of Bundlekund. Average length from 16 to 18 feet, and from 18" to 14" in thickness. May sometimes be procured of a larger size than this; and is a good serviceable timber, if properly seasoned, by being left for a couple of months in a running stream. Muhwa timber is used for chowkuts of doors, plank doors, wall plates, and principals, &c. in roofing, and for the latter purpose is reckoned the next best wood to saul wood. It would I think answer very well for the large beams in bridges if it could be preserved from ghoon.
	Khyre, ..	(No.) Plentiful on the hills, and in ravines.	Agra and Bombay Road.	Hard and brittle. ..	This wood is plentiful on the hills, and in ravines in most of the forests; and seasoning by placing in a dung hill is recommended. It answers well for uprights, and receives a good polish. Lengths from 12' to 14' diameter 8" to 15". Frames for hackeries, ploughs and pivots for sugar mills, are made of this wood, and it may be felled in the forests without purchase money.

BABOOL, ..	(No. I.) between Sasram and Gonah, and for miles east and west.	Agra and Bombay road.	It may be classed as the best sort of wood for trenails. If well seasoned in water, it will neither rot or ghoon.	This description of wood is well known, and generally procurable at most villages between Sasram and Gonah, and for miles east and west; varying in diameter from 3" to 1½' and 2': and may be purchased at 6 annas to 3 and 3½ rupees.
TEAK, ..	Between Jubbulpore and Nagpore.	Great Deccan Road.	This is too well known to need description.	At present much teak of a large scantling cannot be obtained very near the line of road, for the demand for it was so great, and the natives so reckless in the destruction of undersized trees, that in a few years the forests here were likely to be denuded of teak. Fortunately, the Deputy Commissioner reported the circumstance to Government, and in 1847, received orders to prevent the indiscriminate cutting of teak. The young trees abound and look very flourishing, and this forest promises in a few years to become a very valuable one.
TENDOO, ..	In the jungles at Mungowah, also in the jungles bordering on the Nagpore Road.	Great Deccan Road.	It has a slight degree of elasticity; should be kept well exposed: if buried will soon be attacked by worms, &c.	It is used for Palkee poles, axle-trees, &c., and the ebony makes good wheel boxes, and the numerous fancy articles to which it is applied. It weighs per cubic foot 70 lbs.
DITTO, ..	Plentiful in the Forests.	Agra and Bombay Road.	If well seasoned in water and felled at the close of the rains, is durable and tough.	Frame pieces and wooden axles for hackeries are made of this wood, varying in diameter from 6' to 2'. Readily attacked by ghoon, but never rots. Length from 15' to 18' and may be felled in the forests without purchasing
DITTO, ..	In the neighbourhood of Adjegurh and Bisramghat.	7th or Cawnpore Division.	It resists the effects of water, and does not warp in the sun nor rot.	Grows in considerable quantities. Average length 10 to 12 feet, 4' inches in diameter below, and 3' above. is a good serviceable timber when left to season for 3 or 4 years:—should be cut after the rainy season; and is well adapted for parts of wooden bridges. It is procurable in shape of bullocs or beams. It is mostly employed by natives in the construction of hackeries and other articles requiring a durable kind of timber.

Statement of Timbers procurable on the Agra and Bombay Road, Great Deccan Road, Gwalior and Cawnpore Divisions of Public Works.—(Continued).

Name of Wood.	*Where found.*	*Division.*	*Nature and Properties.*	REMARKS.
KOAH, ...	In Budowrah and Sirsee Mow Forests.	Agra and Bombay Road.	If well seasoned in water is elastic and tough.	Hackeries and frames are made of this wood, varying in diameter from 1' to 1½'. Sometimes rots and ghoons. It may be procured in length from 18' to 25' and may be felled in the forests without purchasing. The only expense would be felling, scantling and carting.
BEEJAH SAL,	In the neighbourhood of Mungowah, also in the jungles bordering on the Nagpore road.	Great Deccan Road.	Liable to split, but is very durable, and the least moisture will cause it to throw out stains.	It is much used in house building, particularly where large beams are required, for it combines great lightness with great strength. Now that teak is difficult to be obtained in these jungles, Beejah Sal in a great measure supplies its place. It weighs per cubic foot 66lbs.
SAJ, ...	Ditto, ditto.	Ditto, ditto.	It is heavy, sinks in water, close grained and durable.	Grows to a height very straight, and timbers of 50 feet in length and 12 inches square are obtainable. Much used in house building and constructing carts. A cubic foot weighs 75lbs.
SESSU, ...	Ditto, ditto.	Ditto, ditto.	Is a handsome close grained, black, strong and durable wood.	Grows to a considerable size and is obtainable in timbers 18 feet in length with a scantling of 18". Out of twelve trees, eleven of them will be of no great use to the cabinet-maker, for the heart of the tree is generally cracked, and filled with a kind of petrified resin. The natives use it for toothed combs, also for felloes of wheels, writing desks, &c. Weighs per cubic foot 78lbs.

DHANGAIRI,	In the neighbourhood of Mungowah, also in the jungles bordering on the Nagpore Road.	Great Deccan Road.	Is a close-grained and very strong wood.	Timbers of 16 feet in length, and 12 inches scantling are obtained with difficulty. I think it rather liable to split. Weighs 69 lbs. per cubic foot.
PURSUDH, ..	On the Sohagee hills.	Ditto ditto.	Is a dark, very heavy, durable, close-grained, and hard wood.	It is used for door frames, and trusses; timbers of about 12 feet in length and 9 inches square may be obtained from the trunk of the tree. A cubic foot of this wood, when dry, weighs 102 lbs.

H. GOODWYN, LIEUT.-COL.,

Superintending Engineer C. P.

No. LVIII.

NOTE REGARDING THE POPULATION OF ZILLAH MUTTRA.

In the district of Muttra, a census was taken of all the inhabitants on December 31st 1849; and again on December 31st 1850. The result, when compared with the census of 1847-48, given in the printed Statistical Memoir, affords some grounds for judging of the annual increment of the population in a well-peopled and flourishing district in the North Western Provinces. Mr. Robert Alexander, the Collector of the district, thus describes the mode in which the census was taken. "The plan pursued was to have the form translated and placed in each putwarree's hands by the 25th December, and the tehseeldar was desired to provide, that, through the qanoongoes and other officers, every putwarree should be made acquainted with paragraphs 137 to 143 of the printed Circular. When more than one village was under one putwarree, the enumeration in the second village was to be made through his gomashta. When neither of them could be present at a particular village or nuglah, the enumeration was directed to be made by lumberdar or trader or pundit, if there resident. On failure of such residents a Tehseeli officer or chuprassee, who was able to read and write, was to be sent to supply the information and enter it into the form. The assistance of the Magistrate was obtained in securing the census in towns through the chokeydars and mohullahdars. As many officers as could be spared from the Tehseel office, were sent on the same day *to pertál* or test the enumerations in different villages, and as the assistance of police jemadars and mohurrirs was obtained in the testing, very few villages were left with the census not tested."

Abstract Return of the number of Persons, who, on the night of December 31st 1849 (or Poos 1257 Fuslee,) were present in the Pergunnahs of Zillah Muttra.

Number.	Name of Pergunnah.	Number of Enclosures.	Number of Houses or Families.	Hindoos.				Mahomedans and others not Hindoos.			
				Agricultural.		*Non-Agricultural.*		*Agricultural.*		*Non-Agricultural.*	
				Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
1	Huzoor Tehseel, ...	6216	20957	12049	7738	34865	30662	663	586	4631	3804
2	Areeng, ...	6942	17669	33127	28642	8051	7094	1972	1495	829	685
3	Suhar, ...	6628	19298	35123	30254	10202	8992	1829	1627	1978	1629
4	Kosee, ...	2746	14756	21801	18550	8298	7442	1655	1487	1907	1649
5	Nohjheel, ...	1957	8863	12842	10669	9688	8894	332	291	1080	1037
6	Maât, ...	9361	17821	37565	32031	9399	7500	1491	1322	1485	1228
7	Muhabun, ...	2933	16144	24817	20949	15819	14126	575	470	1654	1673
8	Sadabad, ...	10740	19952	25390	20584	25291	23201	472	408	2946	2641
9	Julesaur, ...	5739	26801	48822	39646	19632	16865	2579	2215	4968	4703
	Total, ..	53262	162261	251541	208863	141244	124776	11567	9891	21478	19049

Abstract Return of the number of Persons, who, on the night of December 31st 1850 (or Poos 1258 Fuslee,) were present in the Pergunnahs of Zillah Muttra.

Number.	Name of Pergunnah.	Number of Enclosures.	Number of Houses or Families.	Hindoos.				Mahomedans and others not Hindoos.			
				Agricultural.		*Non-Agricultural.*		*Agricultural.*		*Non-Agricultural.*	
				Males.	Females.	Males.	Females.	Males.	Females.	Males.	Females.
1	Huzoor Tehseel, ...	8091	21799	11525	11298	36737	31536	657	573	4142	3513
2	Areeng, ...	7122	18584	35391	30191	8123	6942	2140	1593	861	693
3	Suhar, ...	7132	19937	36762	32287	10115	8829	2377	2029	1732	1472
4	Kosee, ...	2861	15513	22260	19218	9018	8188	1617	1480	2038	1700
5	Nohjheel, ...	2145	9589	13609	11362	9847	8916	466	422	1030	932
6	Maát, ...	9793	18343	39313	33557	9299	8112	1627	1411	1194	1118
7	Muhabun, ...	2929	15948	25921	20911	17168	14681	595	508	1833	1683
8	Sadabad, ...	10739	19167	26320	21639	25246	25975	500	408	3039	2806
9	Juleisur, ...	4436	25756	46183	37019	22043	19220	2513	2121	5058	5064
	Total, ..	55248	164636	257286	217485	147626	132399	12492	10545	20927	18981

Abstract.

Date of Census.	Hindoos.			Mahomedans.			Total.		
	Agricultural.	Non-Agricultural.	Total.	Agricultural.	Non-Agricultural.	Total.	Agricultural.	Non-Agricultural.	Grand Total.
In 1847-48 from printed Memoir, ..	349065	299627	648692	14066	38930	52996	363131	338557	701688
On December 31st 1849, ...	460404	266020	726424	21458	40527	61985	481862	306547	788109
On December 31st 1850, ...	474771	280025	754796	23037	39908	62945	497808	319933	817741

No. LIX.

STATISTICS OF FURRUCKABAD.

Report dated 22*nd September* 1851, *from* W. H. D'GRUYTHER, ESQ., *Deputy Collector, addressed to the* SECRETARY *to* GOVERNMENT, *North Western Provinces, regarding the Statistics of Furruckabad, and a Census taken on the* 31*st December* 1849.

SIR,

I now beg to forward the revised Statistical Table, with a report of the measures adopted by me in this district, with the view to carry out the wishes of Government in obtaining accurate returns of the area and population (col. 3 to 9 and 19 to 23 of the Table).

Mouzahs.—2. Under this head *mehals* and not mouzahs had been entered in the former returns, but the number now given in the present return is the number of *mouzahs* formed by the quantity of land that the surveyor has embraced in one map or "hulka" in his professional survey, whether it includes two or more estates separately assessed, or only a *muzrah* the Settlement of which is included in another estate.

Area.—3. In the Table printed in the "Statistical Memoir," the area was that given by the khusrah measurement, conducted by the surveyor's mootsuddees; excepting such estates as had been remeasured, and of which the total and malgoozarree areas were taken from the papers of the last measurement. In all others, the cultivated and culturable lands, as entered in the khusrah of Settlement, were put down.

4. In the revised return, the cultivated and culturable lands were taken from the putwarees' papers of 1255 Fuslee, and the *total area* according to the surveyor's khusrah measurement (excepting where the estates were remeasured,) to which was added, by measurements effected through the putwarees, the tracts of waste and unculturable lands, and dhak-jungles, that had been excluded by the surveyor's mootsuddees in the khusrah from the surface brought under measurement.

5. In the modified return herewith submitted, the cultivated and culturable lands have been taken from the putwarees' papers for 1256 Fuslee (being the year corresponding with 1850, when the

census was taken,) and the *total area* is according to the professional survey; the entries having been carefully extracted from the surveyor's maps. This therefore corresponds with the area in Statement No. IV. of Settlement, in all cases where the area has not been since altered by diluvion, boundary disputes, &c.

6. While on this subject, I may state that the alleged causes of errors in the area columns, as noticed in page 6 of the "Memoir," received my best attention; and the totals have been carefully made up and tested, both by the Mofussil and Suddur establishments; and with the view to ensure correctness, the individual making the totals was held responsible by his name being affixed to each page: while not more than 12 villages were allowed to be entered in a page, so as to render the addition of the figures easy, and with greater certainty of accuracy.

7. It was discovered in the course of my enquiries, that the Tehseeldars had proceeded upon conflicting principles as to the description of land which should be placed under the head of *culturable;* some of them having thrown the old bunjur into the column of barren, and others having included in the culturable area the lands occupied by topes, dhak-jungle, &c. In order therefore to ensure a uniform classification of the soils, I merely required of the Tehseeldars to prepare and send in a return agreeably to the Form B., from which the classifications were made at the Sudder Office; thus, "Cultivated;" "Under actual cultivation, including fallow."

Culturable.—This includes old and new bunjur, and lands fit for cultivation, but occupied by dhak-jungles, and gardens.

Barren.—Under this head is included *abadee*, tanks, topes, *oosur*, ravines, sand, and the like, together with such portions of dhak-jungle, where no cultivation can be carried on.

8. The result of the enquiries and alterations that have been made, shows the *total area* now to be 13,58,272 acres instead of 12,22,287 as entered in the "Statistical Memoir;" (and it is also 6,902 acres in excess of the total given in my Revised Return of 20th July 1850)* while the number of square statute miles is 2,122 instead of 1,910. The Deputy Surveyor General in Calcutta, in the comparative table furnished with his letter dated 23rd August 1849, to the address of Government, fixes the area of this district at 2,178 miles, so that the difference required to be accounted for is now only 56 square miles, instead of 268; and this I proceed to explain.

* By present return, ...	1358272
By revised return of 20th July 1850,	1351370
Increase in present return, ...	6902

9. The Deputy Surveyor General has, in his calculation, included the whole breadth of the channel of the river Ganges from the village of Daicpoor in pergunnah Kanouje, to the village of Bybulpoor in pergunnah Kumpill, a distance in length of about 63 miles; whereas a reference to the professional village maps shows that unless the river has intersected a village (*i. e.* runs between its boundaries) the breadth of the channel is excluded from the area given by the Revenue Surveyor in his village map; the boundary of each village terminating with the banks of the river on either side. The surface thus left out in the returns of this office is computed at 49½ square miles; thus making the total area of this district 2,171½ which leaves a difference of only 6½ square miles between the Deputy Surveyor General's computation and the present return. The latter may therefore be assumed to be true, since the discrepancy between it and the professional return is so very trifling.

Population.—10. As regards the census; it was my care so far back as August 1849, to make arrangements for the numbering of dwelling houses, shops, choupals, worshipping places and all other public buildings in which people were known to reside. The process of numbering was completed through the agency of the police in large towns and qusbahs, aided by the *mohulladars*, and extra mootsuddees, and by putwarees in the villages. Every precaution was taken to ensure the exact performance of this duty, which was in fact the basis of the census; and it may not be out of place to notice here, some of the particulars connected with this branch of the work. Every town was parcelled out among a certain number of individuals, according to sub-divisions of *mohullas*, and each parcel had its own series of numbers, and so had every *muzrah* or *poorwah* detached from the parent village. The No. was painted in red, on the right hand side of the front door, and the figures were not less than an inch in size. As many persons as had one *choolah* in common were considered as members of one family, and when it happened that the inmates in one family had separate *choolahs*, they were regarded as distinct families, and each had a distinct number affixed to his house; and in the third column the name of the particular individual, who was recognized as the head of that separate family, was inserted.* In these cases, as well as those where several houses were surrounded by an enclosure, all the numbers of the houses were painted over the gate of the enclosure, in addition to having them on the wall near the door within; but the numerical numbers of enclosures were only written in the Return and not painted on the gate. The numbering of the house in the city and station was tested by the two kotwals, and in

* See Return at page 175 of the Memoir.

the mofussil by the tehseel officers, and also by myself. In each tehseelee, the peshkar was specially made responsible for this work, and every village was visited by him and a weekly progress report furnished. By this method, not a single house was omitted; and thus by a little care we obtained an exact return of houses, and a confidence was felt that in the process of enumeration of the people there was little fear, that any material error could occur from any dwelling being overlooked. The difficulties encountered in this undertaking were inconsiderable, and may be summed up in a few words. At first the people seemed to be alarmed, and suspected that the numbering was preparatory to a general taxation: but their fears were easily removed. Some of the executive officers reported that there were many houses without door posts,—where then was the No. to be placed? Others were puzzled how to proceed with huts constructed at the river side with reeds and tamarisk bushes. Some of the householders in their anxiety to preserve the No. painted at their doors, covered it with a tile, and plastered it over so as effectually to conceal it from view, &c. &c. In the course, however, of my tour into the district in the cold season, I caused all such difficulties to be satisfactorily adjusted, and took particular pains to furnish the local officers with ample instructions as to what was required of them; explaining personally, both to them and to the putwarees, the principles of procedure and the object proposed to be attained. I was enabled by the measures adopted to have the returns of the numbering of houses with the names of the heads of families completed by the middle of December 1849.

11. Having alluded above to the preliminary process, I now proceed to offer a few remarks relative to that of actual enumeration; and first, all village carpenters, blacksmiths, laborers, zemindars, maafeedars, putwarees, and all others who derive any support however small from pursuits connected with the culture of land, or who are paid in grain instead of money for their labor, or the exercise of their craft, have been classed as agriculturists, together with their families. Among the generality of inhabitants in a village there are indeed few who do not come under the category. Having settled the mode of classification, the next thing was to hold responsible those that were told off for the duty of enumeration; and in order to do this with precision, I had a register prepared of all the enumerating officers. Every tehseeldar was required to furnish a list of all those putwarees who had more villages than one under their charge, and when the number was found to be more than a single individual could well manage in a day, the surplus villages were made over either to the relatives of the putwaree or to some intelligent zemindars, and the names of these parties were then entered on the register. By this plan, the people were told off for

their respective circles, and it could at once be ascertained by whom the enumeration was made in any particular locality, whether by the police establishment or *mohulladuars* in a town; by the putwaree, his relatives or headmen of a village: or by *theeka mohurrirs* specially engaged for the purpose, in the city and cantonments; and in order to familiarize them with what they were required to do, to obviate delay of classification into agricultural and non-agricultural on the 1st January, and for the more correct ascertainment of the number of resident persons in each house, the enumerating persons were made to prepare a rough census some days before the 1st January, testing the accuracy of the statement of each head of a family by enquiring among his neighbours; and this return, leisurely prepared, became an excellent guide for them, on the fixed day in filling up the fair return of the actual number of persons that slept on the night of the 31st December 1849 in one house; because any differences that appeared, were at once made the subject of investigation, and the cause satisfactorily ascertained.

12. As travellers frequently prosecute their journey at night, I caused the enumeration to be made, at the several surais and halting places throughout the district, on the night of the 31st December, after 9 o'clock.

13. On the morning of the 1st January 1850, in addition to the men previously appointed for the duty within the city and the station, I engaged the services of the whole of the Establishment of the Collectory and Fouzdarry to assist in it. They were required to proceed in company with the enumerating officers, whether *mohulladar, punch,* or *mootsuddee,* from house to house through the sub-divisions assigned to their charge, and to see that the entries were correctly taken down. Within the cantonment bazar, the enumeration was made by the regimental chowdry under the orders of the Commanding Officer, and the returns of the households of the Nuwabs enumerated with the family of the *Raees,* were procured through the Agent to the Lieutenant-Governor, as they objected to the instrumentality of the police. From the European residents, the returns of their families and servants were obtained by circular.

14. The census being completed, I directed the tehseeldars and thannadars to have the results tested within three days in the mode prescribed at page 175, of the "Memoir." In the villages the enumeration was tested by the subordinate officials; a certain number of villages all lying in one direction being assigned to each, and in the large towns this duty was undertaken personally by the tehseeldars and thannadars themselves; so that every village was visited and tested by some official between the 1st and 4th January. In the city of Furruckabad, the process of testing was conducted by Mr. Cunninghame, and myself; while the station was assigned by

Mr. Cunninghame to Mr. Raikes the Joint Magistrate; and the result of this testing was most satisfactory. I have only to add further that I had the totals of the detailed returns computed with great care, and from these the abstracts were then prepared. The result gives a population of 10,03,073 souls for the whole district or 472 to a square mile,* and I have reason to believe that this is trustworthy, being as close an approximation to the truth as it was possible to attain.

I have, &c.,

W. H. D'GRUYTHER,

Deputy Collector.

FURRUCKABAD COLLECTORATE,
22*nd September*, 1851.

* *I. e.* 472 to a British statute mile; and 625 to a square Geographical mile.

APPENDIX I.—FORM B.

ALLUDED TO IN PARA. 7 OF REPORT, DATED 22ND SEPTEMBER 1851.

Return shewing the Rubha of Pergunnah *Tehseelee* *Zillah Furruckabad.*

Number.	Names of Mehals.	Numbers of Nuglahs or Mouzahs belonging to each Mehal.	Names of Nuglahs and Mouzahs.	Total area according to General Statement, No. IV.	AREA AGREEABLY TO THE PUTWAREE'S PAPERS FOR 1256 FUSLEE IN BEEGAHS.														LANDS NOT MEASURED BY SURVEYOR'S MOOTSUDDEES.				Total area of the Mehal.	Note whether the entries in the Putwaree's papers are agreeably to the Surveyor's khusrah or any other measurement.	Remarks.
					Cultivated including Fallow.	New Bunjur.	Old Bunjur.	*Dhak-jungle.* Culturable.	*Dhak-jungle.* Uncultivable.	Lakhiraj.	*Padaruk lands.* Cultivated.	*Padaruk lands.* Bunjur.	*Topes.* Cultivated.	*Topes.* Uncultivated.	Gardens.	Abadee.	Tanks, Jheels and Pokhurs.	Barren Waste Ravines, &c.	Total as per Meelann khusrah.	*Dhak-jungle.* Culturable.	*Dhak-jungle.* Uncultivable.	Barren Waste.	TOTAL.			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27

NOTE.—In the present Return the entries of Cols. 6, 12 and 14 of this Statement have been placed under the head of Cultivated.
7, 8, 9, 13, 16 and 21, ditto ditto, ... Culturable.
11, ditto ditto, ... Lakhiraj.
and all remaining Columns under the head, ... Barren.

W. H. D'GRUYTHER,
Deputy Collector.

APPEN

Modified Statistical Return of the Area and

Pergunnahs.	Number of Mouzahs or Townships.	Area in square Geographical miles of 547·2 acres each.	Area in square statute miles of 640 acres each.	Area in Acres.	Malgoozaree or assessed land.	
					Cultivated.	Culturable.
	3	4	4½	5	6	7
Azumnuggur, ...	191	187	248	158547	98710	18761
Puttialie, ...	60	49	65	41535	25391	9858
Burnah, ...	28	28	37	23855	16896	3723
Shumsabad, ...	241	143	188	120425	66574	19915
Kumpill-Kaimgunge, ...	190	131	174	111126	53302	27685
Chibramow, ...	122	92	121	77636	43196	13947[a]
Taligram, ...	103	83	111	70811	41345	10832
Islaungunge, ...	89	92	121	77563	38845	15083
Purrumnuggur, ...	30	22	30	19029	9833	2417
Khakutmow, ...	42	23	31	19792	12604	2636
Kunnouje, ...	190	136	179	114674	71511	17835
Mohomdabad, ...	40	38	50	32142	15072	3325
Bhojepoor, ...	139	82	109	69805	38238	10643
Pahara, including station of Futtehghur and city Furruckabad,	78	31	41	26432	9458	3002
Shumsabad, Huzoor Tehsil, ..	106	99	130	83361	44160	9191
Thutteea Tirooa, ...	127	167	222	141947	64254	21662
Suckutpoor, ...	147	103	136	86966	36684	10092
Sowruck, ...	45	67	88	56219	30267	11524
Suckrawah, ...	29	31	41	26607	0	0
Total, ...	2017	1604	2122	1358272	716343	212131

Furruckabad Collectorate,
The 22nd September, 1851.

DIX II.

Population in the District of Furruckabad.

Minhaee or unassessed land.		POPULATION.						
		Hindoo.		*Mohomedans and others not Hindoos.*				
Lakhiraj.	Barren.	Agricultural.	Non-agricultural.	Agricultural.	Non-agricultural.	TOTAL.	No. of persons to each square geographical mile.	No. of persons to each square statute mile.
8	9	19	20	21	22	23	24	25
1677	39399	66913	16369	4095	3896	91275	488	368
81	6205	15189	5188	3700	2753	26830	547	413
0	3236	9806	1777	262	197	12042	430	326
6104	27832	57444	16818	3014	3992	81268	568	432
4251	25888	44750	17507	5077	10158	77492	591	445
5959	14534	39783	12551	802	2988	56124	610	464
101	18533	34159	9793	3180	3593	50725	611	457
51	23581	38140	11202	1495	2040	52877	575	437
0	6779	9945	3417	55	267	13684	622	456
0	4552	12299	4129	79	401	16908	735	545
181	25147	62044	28343	5910	9801	106098	780	593
1139	12606	15504	3572	491	539	20106	529	402
13401	7323	32260	14899	5201	3031	55391	675	508
5884	8088	17465	75334	1050	34047	127896	4125	3119
4275	25735	37378	8928	573	1023	47902	484	36
0	56031	61689	13463	2880	2629	80661	483	363
91	40099	36667	6145	598	699	44109	428	324
591	13837	22659	3743	623	718	27743	414	315
26607	0	11211	1723	506	497	13942	449	340
70393	359405	625305	254906	39593	83269	1003073	625	472

W. H. D'GRUYTHER,
Deputy Collector.

APPENDIX III.

Population Return of the District of Pattookotah as per Census taken on the 1st January 1850.

Name of Township &c.	Names of Pergunnahs.	Number of Houses.	Distribution of Population. — Rural — Agricultural — Male.	Rural — Agricultural — Female.	Rural — Agricultural — Total.	Rural — Non-agricultural — Male.	Rural — Non-agricultural — Female.	Rural — Non-agricultural — Total.	Rural — Total — Male.	Rural — Total — Female.	Rural — Total — Total.	Municipal — Agricultural — Male.	Municipal — Agricultural — Female.	Municipal — Agricultural — Total.	Municipal — Non-agricultural — Male.	Municipal — Non-agricultural — Female.	Municipal — Non-agricultural — Total.	Municipal — Total — Male.	Municipal — Total — Female.	Municipal — Total — Total.	Grand Totals — Male.	Grand Totals — Female.	Grand Totals — Total.	Proportion of Hindoo Females to Males per cent. as per Column 11.	Proportion of Mahomedan Females to Males per cent. as per Column 14.	Proportion of Females to Males, per cent. as per the entire population of the District as per Columns 23 and 24.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Adamnuggur	Adamnuggur, Pattalie, Bettah,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Shumshul	Shumshul, Kunyeh-Kuingunge,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chitwanee	Chitwanee, Tulgrun,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sumtgunn	Islungunge, Purrunnuggur, Khelebaree,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Kunnuja	Kunnuja,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mahomedabad	Mahomedabad, Bhuggeat, Pahara, Shumshad, Huzoor Tahsil,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tantoee Tirree	Tantoee Tirree,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sudulpore	Sudulpore, Sumruh, Sudeewah,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Total,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	City of Pattookotah,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Station of Futtehgurh,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Total of the District,	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

* Exclusive of City and Station which are separately given; with other Proposals Total.

Pattookotah Collectorate,
The 31st September, 1851.

W. H. DUBUTTHER,
Deputy Collector.

APPENDIX IV.

Statement shewing the proportion of women to men among the different castes of Hindoos, in Zillah Furruckabad, agreeably to the census taken on the 1st January 1850.

No. of Villages in the District, inhabited by each class of Hindoos.	Caste.	Number of Men.	Number of Women.	Proportion of Women to Men per cent.
189	Rajpoots, ..	17206	10763	59
204	Aheers, ..	15595	12340	79
118	Chumars, ..	5614	4559	81
158	Brahmins, ..	11514	9459	82
128	Kachees, ..	9633	7944	82
64	Koormees, ..	6910	5739	83
188	Kissans, ..	17218	14843	86
1049	On the entire Hindoo population of the district.			81

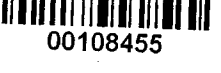
N. B.—This statement shews the population of each caste only in those villages in which the chief number of the inhabitants are of that class. It does not shew the entire population of each caste in the whole district. But inasmuch as the scattered portion do not probably exceed the number entered here, and as the villages given above form a moiety of the whole number in the district, the Statement may be received as affording a fair criterion for each caste.

All the tehseeldars with the single exception of Syed Mohumed of Kunouje, agree in attributing the disproportion of women to men, among the Rajpoots to the circumstance of there being a large number of bachelors among them; and the reason they assign for this anomaly in Hindoo usages, is the heavy expense which immemorial custom has rendered necessary, it may be said obligatory, on occasions of marriage; and that it therefore becomes a very difficult matter for parents with a family of daughters to find suitable matches for them.

This can scarcely be admitted as a valid argument, because it does not apply to other parallel cases; for the brahmins are similarly situated, being subject on the daughter's side to considerable expense in marriage ceremonies, and old maids may be found in many families, yet the proportion of women among them is fair and uniform with the other castes. I am therefore inclined to accept the suggestion of the tehseeldar of Kunouje, that the great disproportion of one sex to the other among the Rajpoots, is owing to the secret prevalence of the barbarous practice of female infanticide.

There is no reason whatever to think that any concealment of the truth was practised in regard to the number of females at the time the census was taken.

W. H. D'GRUYTHER,
Deputy Collector.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